ENGINEERING NEWS.

Ex-Gov. SMITH, President of the Vermont Central, has come out with a rather flippant and ill-judged letter anent the awful disaster on his road, declaring in effect that he "dont know nothing" of any possibilities in the way of steam heating, and will the newspapers please tell him? That President SMITH should not have known before his late shocking experience that one system had been in use on the Dunkirk, Allegheny Valley & Pittsburg for four years, on another road for three years, and another road for nearly one year, with entirely satisfactory results, and that another system had been in use in New York City for nearly twice as long with equal success, was pardonable. That he and some other presidents of greater lines should have been so little awed by the disaster as to venture to throw aside with a sneer in public declarations all that has been accomplished as proving nothing, was at least in the worst of taste, and has a certain "What are you going to do about it?" tone which does more than actual wrongs to provoke hostile legislation. The possibility of heating cars by live steam from the locomotive without serious loss, and probably with a saving, has ceased to be debatable or doubtful as an engineering question, and these gentlemen will be consulting the interests of their companies, and appear more creditably before the public by giving seasonable attention to the only remaining question, what system is best and just what its details should be.

ACCORDING to the latest *Bulletin du Canal Interoceanique*, the total output of material on the Panama Canal for the year 1886, was 11,727,000 cu. m. This is very nearly the 12,000,000 cu. m. promised some time ago by M. DE LESSEPS. In dividing this amount among the workings, we find that Gatun turned out 2,826,000 cu. m.; Colon, 1,555,000; Emperador, 1,008,000; La Boca, 1,211,000 and the derivation canals, 1,382,000 cn. m. The remaining amount is scattered over ten other working points. This is doing very well, there is an appaling mass of rock and earth yet to move, and some ugly water courses to be provided for.

ANOTHER knight-errant has started for the North Pole, overland from Winnepeg, accompanied only by a drug clerk 1,400 lbs. of provision, and a letter of credit on the Hudson Bay Co. It is impossible not to respect his pluck, even if we do not his intelligence.

IT is reported that Prof. WM. GESNER and G. W. WEST have found asphalte in Alabama, of a purity of 81.34 per cent. This valuable mineral find is located "in the vicinity" of that phenomenal Birmingham; but whether it is a real discovery, or simply an escape of natural gas somewhere among the mineral products of Alabama is yet to be determined.

THE Northern Pacific Railroad announce that they are building an experimental iron car, especially for heating passenger trains, thus in effect assuming that the question of distributing the steam to the cars effectively is the less serious one, and the sparing of steam from the locomotive the more serious one. We surmise that they will find it on trial the other way.

IT is stated by Master Car Builder ADAMS, of the Boston & Albany, that it costs $50 per car per year to heat them by the ordinary stoves and heaters, apparently for fuel only.

A RECENT derailment and smash-up on the Dunkirk, Allegheny Valley & Pittsburg, Jan. 6, illustrated practically the value of steam heating. The cars, like all on the road, were fitted with the Martin heater, but the old stoves were still in them, full of dead ashes which fell on two men who were by the overturning of the car imprisoned within it so tightly that it took ten minutes for them to get out. What would have happened had the coals been alive may be imagined.

Mr. J. D. HAWKS, Chief Engineer of the Michigan Central Railroad, has submitted plans for a bridge across the Detroit river "to be used only in winter when navigation is closed." As planned the bridge will be 2,600 ft. long, with two separate draw-spans, on the Michigan and Canada shores, with 200 and 300 ft. openings. The center-span of 400 ft. is to be removable in the season of navigation; besides this there would be four fixed spans of 300 ft. and one of 200 ft. The bridge would be a through-bridge with only 25 ft. headway above the river. The deepest water is 40 ft., but to found the bridge on bed-rock, as proposed, would require piers about 120 ft. in total height. The bridge would be double-track and is estimated to cost, in iron, $1,500,000. This novel bridge project has been brought to the attention of Congress and is reported upon favorably as a winter bridge. We very much fear that when this 400-ft. span is once in place, "engineering difficulties" of an insurmountable nature will interfere with its removal, and the structure will be a *summer* as well as a "winter bridge."

THE Pennsylvania Railroad will soon have a four track line from Jersey City to Philadelphia. There are already four tracks from Philadelphia to Holmesburg and from Bristol to Trenton; and contracts will be given out shortly for the construction of two additional tracks for about 16 miles near Monmouth Junction. The management of the traffic will be greatly facilitated and the express trains will be able to make the run in a shorter time. The Consolidated Railroad is also quadrupling its line. Two additional tracks are to be laid as far east as Mamaroneck this season and will be used for freight traffic. The work will be pushed on to Stamford, Con., and ultimately to New Haven.

Time is already justifying the view which we expressed of the Inter-State Commerce Bill at the time of its passage (Jan. 22)—that it was a needed, and on the whole a beneficial measure, with more of good and less of harm in it than those more immediately concerned were ready to admit, and that little of possible harm likely to be nullified by cautious and conservative administration. No stockholders are rushing to sell out, and no high railway officials are in a panic of apprehension. The terrible consequences which some would-be organs predicted are not materializing. On the contrary the higher officials are one by one coming to the same view which we expressed. The bill can hardly fail to have a steadying and conservative effect on all the branches of railway construction and operation, and some beginning of such effect seems to be already visible.

It is again announced that the Third Avenue Railway will put in this year a cable system with a double cable from the Harlem River to 63d St., with a subsequent extension to the 14th St. and thence to the Post Office, the speed of the cable being six miles per hour. A semi-official denial that construction would immediately begin appeared the next day, but we infer from what we have gathered otherwise that it was only a cautionary one.

THE Russian Budget for 1887, grants to the Minister of Ways of Communication the total sum of $13,821,235; of this amount, $2,262,900 is for the maintenance and construction of canals; $2,761.30 for roads, and $6,000,000 for railroads belonging to the State. For educational purposes the sum of $74,500 is set aside. Besides the regular grant about $24,000,000 is set aside for "extraordinary outlay;" about $15,000,000 of this being for railway construction mainly in the Trans-Caspian region.

A CORRESPONDENT of a railroad paper of this city, commenting on the value of an accident record which it has issued for some years, says:

"It is probable that your record of train accidents, from year to year, has some relation to the total number which occur in the respective years, although there is no means of determining whether the record has any value of that kind or not. Statistics are certainly dangerous, if relied upon, unless they are correct.

"I subjoin a copy of the accident record for a railway about 500 miles in length, of which I have the statistics for last year. The total number of recorded accidents on that well conducted line amounted to 692. If we calculate the sum of accidents which probably happens in the whole United States according to the standard of this road, we shall have.

500 : 692 : : 130,000 : 179,920

giving a total of 179,920 accidents in the United States, of which you report 1,211, leaving a balance not reported of 178,709. The experience of the little road to which I refer was as follows:

Kind.	No.	Damage.
Head collisions	9	$6,000
Trains breaking	24	8,000
Other collisions	102	13,000
Broken machinery	173	8,800
Defective track	46	1,300
Misplaced switches	26	200
Other causes	312	20,000
	692	$57,000

Subdivided as follows:

Damage to locomotives	$19,000
" " cars	33,000
Cost of wrecking	3,000
	$57,000

"The loss in damage to freight is not taken into this account.

"You give an account of three accidents only from the failure of couplings or draw-bars for the whole United States; that is, only one-eighth of the number resulting in damage, which occurred on this little road."

THE second series of freight train brake tests will take place at Burlington, Ia., some time in May. Ten brakes have some intention of entering with trains of 50 cars, as required by the rules, including 3 electric brakes, and it is likely that 8 or 9 will actually enter. The tests will be all of 50-car trains, and include a "gravity test" of train resistance, hand-brake test and a "break-in-two" test at ordinary working speeds, all of one one run each over a course with four stops on it, with a six runs over the same course, making "emergency stops" with the brake apparatus under test, and three more runs for a "service drop down hill" at 15 miles per hour, in which test some of the brakes made a poor record in the last series. This makes twelve runs for each train, about six of which can be made per day. The tests will be of the highest technical value.

THE *Jigi-Simpo*, said to be the leading Japanese newspaper, in referring to a number of newly projected railroads in that country, especially advises the projectors "to adopt for their model the inexpensive railroads of the United States which are constructed for their practical usefulness and not for the outward appearance." The level-headed editor goes on to remark that it by no means follows that because American roads cost only one-fourth as much as the English in construction, the English are four times as good. He says that in many points the American railroads are superior; and under the circumstances of speedy construction required for the least cash outlay, "it would be much better to have four miles of the American railroad than one mile of the more highly finished English article."

The Japanese editor evidently has in mind the construction of the first railroad in that country by an English company; whereby the English capitalists pocketed an amount of cash inordinately out of proportion to the work done and the Japanese apparently have gained some experience which leads them to seek in other fields for their future railway builders.

Dr. RIABININ, of Tchügüev, recommends testing drinking water by adding 8 to 15 drops of solution of nitrate of silver (one grain of the salt to ½ oz. of distilled or boiled water) to a glassful of water under examination. Nitrate of silver decomposes chlorides and gives a white precipitate of chloride of silver and at the same time precipitates all proteids dissolved in water. If the precipitate be trifling, proportionate to the silver solution added, its surface smooth, color purely and equally white and falls to the bottom of the vessel rapidly, the water is good. If the precipitate is considerable the water contains organic matter; the more considerable the precipitate (in proportion to the solution of silver added) the worse the water. If the surface shows thread-like or flocky processes and is gray in color, the water is bad. A blue discoloration in the water (caused by the chloride of silver combining with ammonia) points to the presence of decomposing vegetable matter; the more blue the worse is the latter. A black precipitate shows decomposing products of animal matter. Sun rays or even strong daylight should be avoided during examination. A violet discoloration, without any preceeding blue, takes place in any water; the earlier this violet discoloration takes place the better the water examined.

Civil Engineering Education.

DISCUSSION.

(*Continued from page 88*).

BY PROF. GEO. F. SWAIN, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, BOSTON, MASS.

The paper of Professor Waddell is without doubt the most valuable contribution to the subject of Civil Engineering Education that has yet appeared, and no one can read it without obtaining many valuable hints, although he may be obliged to differ with the author on some points. I am glad to have the privilege of expressing some views in regard to what a course in civil engineering ought to be. Professor Waddell has arranged an ideal course, which would certainly be thorough, but which is unfortunately impracticable, and not adapted to the conditions in this country at the present time. One of the principal difficulties that higher schools here have to contend with, is the lack of proper preparatory training in the students, and the want of uniformity in preparatory schools generally. An applicant for admission may be able to pass the entrance examinations, and yet be far from qualified to pursue the course to the best advantage, and *vice versa*. If a school were so fortunate as to be financially independent of tuition fees, it might raise the standard of admission by one or two years, and with that as a basis arrange, as Professor Waddell has done, an ideal course of five or six years, thus adding practically two or three years to the courses now generally given. But the writer does not believe that such a course would be at all advisable. In the first place, the number of students seeking such a school would be small, considering the present condition of our preparatory schools, and the institution, under this arrangement, would not be doing the work in the community that it might. In the second place, the greater number of engineering students, judging by the writer's experience, are young men who expect to be obliged to earn their living as soon as they graduate, and who desire to complete their course with as little delay as practicable. Those who form the exception to this statement would be the ones who would perhaps seek a school giving a more extended course. Now the writer believes that a rather better plan than Professor Waddell's, and one which enables the school to cover a much wider field of usefulness, while in no wise impairing its capacity for teaching advanced subjects, is the one by which, with requirements for admission corresponding to what is attainable in the ordinary preparatory and high schools, the regular course is made to cover four years, while *advanced courses*, leading to advanced degrees, may be pursued by students having time and inclination. This is the general plan now followed by several leading institutions. These advanced courses, however, should be carefully laid out, and provision made for teaching every subject of importance.

It must be remembered that there is a limit to the amount of detail which it is in general advisable to teach in a school, depending a good deal upon the character of the students, and whether they have beforehand had any practical experience. The average age of students entering the higher schools, judging from the writer's experience, seems to be not far from nineteen years, and there are many students who afterwards make excellent engineers, who obtain in four years about all that they could profitably get in a school; while there are many things that it is far better for such men to learn after they graduate. Students who desire a more thorough course, and older students, who have had some experience, should be able to get all they desire in the advanced courses.

These views, however, are based on the assumption that the regular four years course is rather differently arranged than is now usual. Many institutions are now, and have for years been engaged in an attempt to crowd into four years what would naturally occupy five or even more, either by resorting to a process of mental compression, or by treating the various subjects very superficially. In the first case the effect upon the student is very similar to that produced by an overloaded stomach, and the superfluous material is very soon thrown off without having been of any benefit to the organism; and in the latter case, the student's conceit is usually developed at the expense of his brains. Some remedy for this is imperative, and the plan which seems most promising to the writer is, first, to omit from the course such studies as will in after life be of limited practical importance to the student (such as higher Chemical Analysis, Zoology, Paleontology, Crystallography, etc., from a course in *Civil Engineering*), and, second, to introduce *options* into the course. In the Massachusetts Institute of Technology, it was found necessary years ago to omit from the civil engineering course many studies which are taught in some other similar schools, and thereby to obtain more time for professional work; and the results have been very gratifying. It had been found that within a year or so after graduating, the students had entirely forgotten whatever they once knew of such subjects as those above enumerated, and as for the training they give it was considered that they could be much better obtained in more purely professional work. In the same institution the use of *options* has been within the past year very extensively introduced, and students, while required to take a certain—and indeed a very considerable—amount in each of the branches of civil engineering, are now allowed, if they choose, to pay particular attention to some one branch, and to devote proportionally more time than to any other. It not seldom happens that a student knows exactly what branch of engineering he is to pursue in after life, and this system enables him to fit himself particularly in that direction; while a student who is uncertain what his future will be, should have a general course embracing all branches in about equal proportion. Prof. Waddell has well alluded to the rapid specialization of engineering, and in view of this fact some such system as the above seems to the writer imperative; at the same time he should not be understood as advocating a narrow training. A course in civil engineering should be very carefully laid out so as to avoid this, by one familiar with teaching, and with the needs of the profession, and should be very carefully balanced. A proper course of this kind requires more instructors than one of the old kind, but it also has the very great advantage that each instructor may be a specialist, and his instruction all the more valuable on that account. One man cannot well teach all the branches of civil engineering with any degree of thoroughness. The thing may be set down as a practical impossibility, and the more instructors, the better the instruction will be.

As regards methods of teaching, Professor Waddell has covered the ground so ably that little more can be said. The subjects, or matter of instruction in schools, may be divided into two classes; the first includes those things, such as mathematics, mechanics, etc.—in fact, those things commonly called theoretical,—which the student will probably not learn at all, or very imperfectly, unless he learns them in the school: the second includes chiefly matters of practical detail, or those things which the student must learn if he is to succeed in practice, and which in many, if not in most cases, he can learn better, and more quickly out of the school than in it. Now I take it that nobody will deny that the first class of subjects—the *principles* of engineering—are the things which first and foremost should be taught, and taught thoroughly. The others should be taught as far as there is time for them. Of course there are many things, such as surveying, of which the principles are best taught by teaching the practice, and of this an engineering graduate should have a very thorough knowledge, but we are dealing now with generalities, and need not go into particulars, as there is no danger of being misunderstood. But I hold that in teaching principles they should be taught *in connection with* the practice. Copious illustrations from practice should be given, and the student should be made to see the practical bearing of everything he learns. He should not be allowed to look upon his machanics and mathematics as entirely independent of and distinct from his practical work, but he should be trained to see their connection. Only in this way, the writer believes, can the student be made to really understand and appreciate and remember what he is taught. In connection with hydraulics, measurements of flow should be made, in some stream or mill flume, and excursions should be made to hydraulic works, and to cities such as Holyoke, Cohoes, Lowell, etc. In connection with bridges, visits should be made to bridge works, if at hand, or to bridges in the neighborhood or in the process of erection. And the very best way of enforcing this method is by actual work in designing, so well emphasized by Professor Waddell. The writer is fully convinced, from his own experience, that there is nothing like it as a mental training for the engineer, as well as an aid to the student in understanding and appreciating the value of his principles. Rightly considered there is no gap between theory and practice; the two must go together. There is no theory which is worth anything which does not take account of actual conditions of practice, and there is no practice which is worth anything which does not, when necessary, make use of the proper theoretical considerations. This the student should be made to see.

It is further very important to teach the student accuracy and, as far as possible, originality. There is no better way to train him in accuracy than by practice in designing, especially in bridge designing; and originality may be fostered by proposing new problems or examples, and getting the student to think for himself, though there are some men who seem to have no power of doing anything that they have not seen done before.

There is one thing to which I think the author of the paper has not directed sufficient attention, and that is, to the study of *English*. In this respect technical schools labor at a disadvantage, and not being able to devote much time to English branches, it often becomes the feeling of students, and sometimes of instructors, that these are of little importance. No idea could be more erroneous. The engineer who can write a good report, who can express himself, clearly and tersely, and who can spell correctly, will have a great advantage over one who has not these acquirements, and proficiency in this direction should be vigorously striven after. On this account the writing of abstracts, reports on various subjects, vacation memoirs, etc., should be introduced as far as possible. In the experience of the writer very good results have been obtained by requiring the students to examine and report on some engineering structure, or on the sanitary condition of a small town, the disposal of its sewage, or the plumbing of some large building. It is nevertheless true, however, that until our preparatory schools do more and better for us in this direction, we shall not be able to accomplish as much as is desired.

Neither can I agree with Professor Waddell in his remarks about modern languages, or in his statement that any work of real value in French or German is very soon translated into English. It is no doubt true that many students leave our technical schools after having studied those languages for years, and yet without the ability to read a book in either of them. This, however, simply indicates a fault in the method of instruction, and I think many improvements remain to be made in this direction, particularly in technical schools. The instruction in French and German should not be left wholly to the teachers of modern languages, but should be taken hold of by the teachers of engineering themselves. The students should be made to appreciate the fact that much of the best literature is in French and German; the technical periodicals in those languages should be put into their hands; they should be made acquainted with the vocabulary of engineering terms; required to make abstracts of important papers, and in this way fairly initiated into the use of the language, and their interest in it, from a technical point of view, aroused. In this way, excellent results may be attained.

The author's remarks about text books, examinations, lectures, etc., are very good. Every teacher of experience will doubtless have found a combination of methods of instruction advisable, depending upon the character of the subject, the time at disposal, the number of students in the class, and other matters. I am inclined, however, to attribute much more importance to the lecture system than is done by Professor Waddell, provided the students are instructed in the taking of notes and required to keep their note books ready for examination. A competent teacher can in one lecture give the student information that he would be obliged to search several books, perhaps in foreign languages, to obtain; he can in a course of lecturers give the students, in many cases, the meat of the subject in a way in which he could not obtain it elsewhere; and he can duly compress or expand the subject with reference to the time of disposal. Professor Waddell's method, of requiring the students to read a great number of books, or "everything of value in

the English language upon the subject," appears to the writer most decidedly uneconomical of time and energy (except for the instructor) if not impracticable, and I believe much better results will be obtained in the same time by covering the subject with a well-prepared course of lectures (if a suitable text-book is not at hand), and spending the remainder of the time which Professor Waddell would devote to reading, in designing or similar work. The writer's practice is to have his notes printed in abstract for the use of the students, who are thus enabled to pay attention to the lectures while in the class room, and relieved in large measure from taking notes. The lecturer can expand the subject to any extent he desires, and the student, with the printed book to guide him, and a few notes taken by himself is enabled to easily complete his notes afterwards. He is still required to have a note book ready for examination at any time. Nevertheless, the fact remains, that the lecture system is best suited for the higher classes, and that for the lower ones is an entirely imaginary one, and may be said to be impracticable at the present time, and with our present preparatory schools. A student going through this course would certainly have no cause to complain of its incompleteness, though there are some details which appear to the writer faulty. For instance, in the first year, forty lectures seem an entirely inadequate number to devote to the five natural sciences named. Would it not be much better to omit entirely the Mineralogy and Lithology, if no more time is at disposal? Again, the number of hours allotted for preparation appear to the writer too large in proportion to the number of lectures or recitations; it having been the experience at the institution with which he is connected that about two hours of preparation to one of recitation is about the maximum which give good results. These, however, are very minor details, and call for no further discussion here.

In regard to drawing, it seems to me that the best results will be obtained by having the drawing in each department supervised by the teacher in that department, instead of by one professor of drawing. In fact, with a large school it is difficult to see how the latter plan is practicable. Each teacher should be enough of a specialist to be competent to look after the drawing connected with the subjects he teaches. In field-work, the class should be divided into sections so small that each man should be kept occupied all the time. This, with large classes, require, of course, a number of instructors. Finally, I cannot fully agree with Professor Waddell that students should be required to spend very much time in making estimates of cost, or in becoming familiar with current prices. I think these are matters which are better left, in great part, for the student to learn after he graduates; and in ninety-nine cases out of a hundred he will have ample opportunity, before he is himself in a position to make a detailed estimate of cost, to see how it is to be made. In the work of designing, economy should, of course, be particularly dwelt upon, and in comparing different methods and projects it will frequently be necessary to refer to price lists or to engineering periodicals for market prices of ordinary materials. And it seems to me more advisable to spend the time in expanding and enlarging upon this side of the question, than in actually calculating the cost of many structures.

the use of some good text book, where there is one, is preferable. Professor Waddell believes in *informal* lectures: the writer thinks that *all* lectures should be to a large extent informal, and that the students should be continually encouraged to ask questions freely at any time.

The author's remarks regarding examinations are excellent. As to the ordinary method of written examinations lasting three or four hours, there can be no question of its inadequacy, and to grade or judge students solely thereby must often be accompanied by great injustice. Oral examinations do not seem to the writer very much better, though he has never tried them extensively; to him the only method seems to be to hold intermediate examinations at intervals, and to take due account of the recitations and general behavior of the student during the term.

The course of study laid out by Professor Waddell

Municipal Engineering; Paper No. 4.*

PHILADELPHIA, PA.

(*Continued from page 105.*)

Water Department.

Reproduction of Drawings.—The common blue-print process (white on blue) is used for reproducing drawings. Experiments are being made with other processes. The frame for making blue prints, being very complete and convenient, is shown in Plate 21.

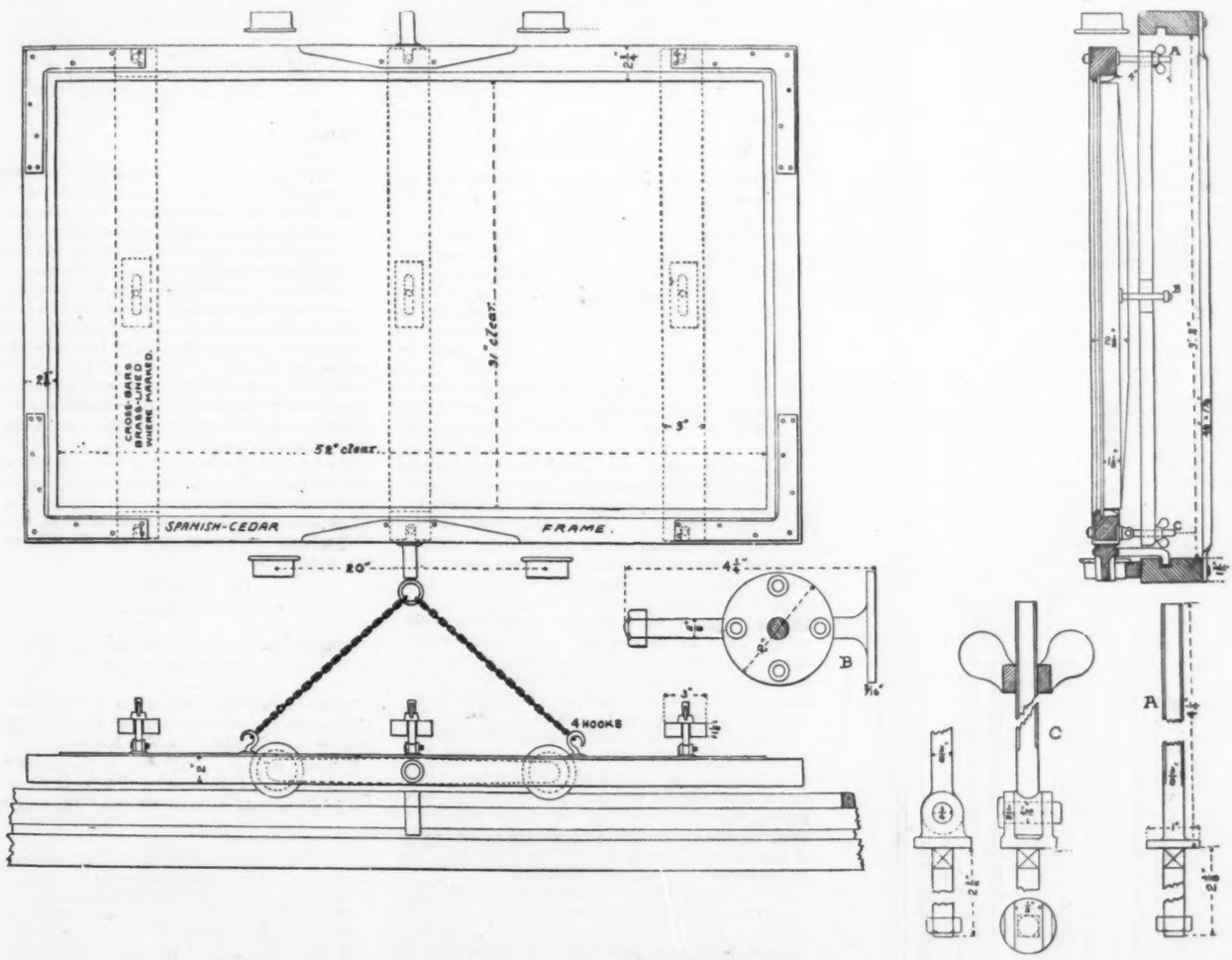

Plate 21—Blue-print Frame; General Plan.

It is mounted on wheels to be run out of the window (on a projecting track, and turns on the same (two) wheels for easy reversal. The pressure board may also be raised and suspended while several small drawings are being placed on the glass, by means of a block and tackle, not shown.

Drawing Board Rack.—Another interesting contrivance in use in the draughting room is shown in Plate 22. It often happens that a man is obliged to leave a drawing unfinished in order to take up a new one which is needed sooner. It is then placed on the rack where it is safe from accident, and may be conveniently picked out from the rest or examined without removing it. The rack has the appearance of a curved section of plain iron fence projecting from the wall, to which it is bolted. Two holes are bored in each end of the drawing board at a distance

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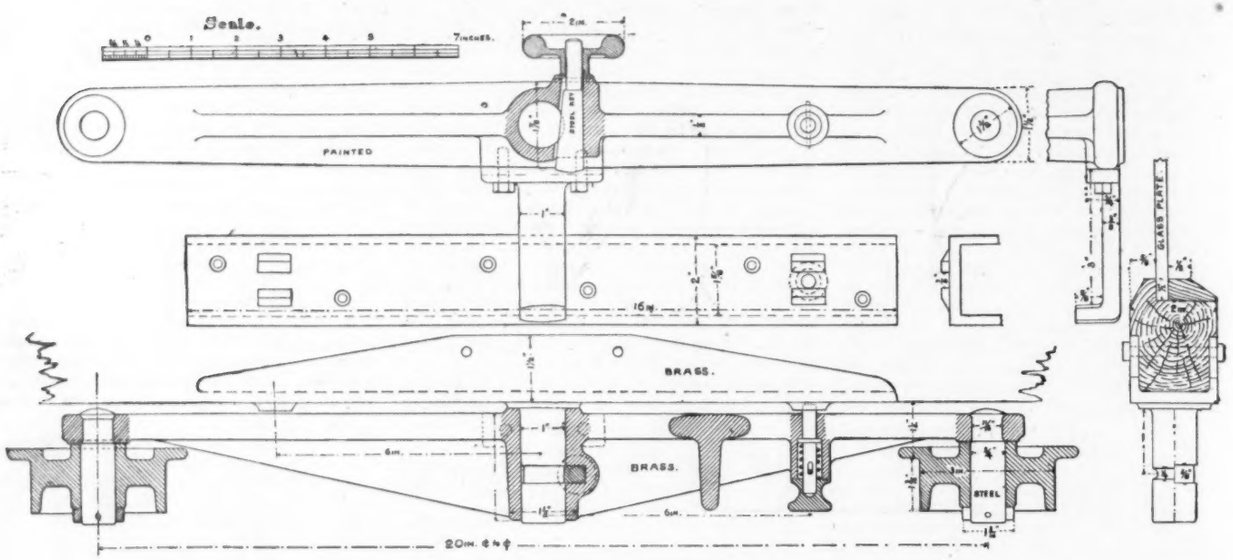

Plate 21a—Blue-print Frame; Details.

apart equal to that between the upper surfaces of the principal members of the rack, and brass pins made to fit the holes are inserted as hinges. The upper pin is held in the board by a smaller pin which passes through it from the top. The lower pin, having an open connection with the rod, is held in by the weight of the board.

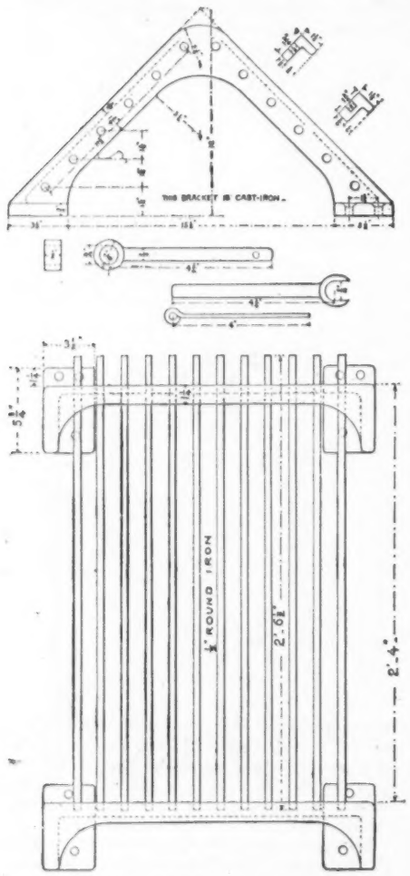

Plate 22.—Drawing-board Rack.

Electrical Department.

Telegraph and other electrical wires and poles are under the control of the Electrical Department, a branch of the city government in existence for thirty years—until recently under the name of Department of Police and Fire Alarm Telegraph, of which service it has the entire management.

It is not lawful to erect poles in any street of the city unless authority has been granted by councils, after permission has been given, a written application to the Chief of the Electrical Department for a license is required, specifying the number and size of the poles to be erected and their location, which must be satisfactory to said official. For this license $5 is paid to the city for every pole, and an annual paying of $1 per pole for license to maintain them. The chief is required to make an examination of all poles once a year and to order the replacement (under penalty) of all found defective or dangerous. Every pole must be legibly marked with a distinctive number and the name or initials of its owner.

Poles in the street are placed on the sidewalks just inside the curbstone, from 140 to 180 ft. apart. No pole is allowed less than 7 in. in diameter at the top, and none less than 40 ft. high except electric light wire poles which are from 20 to 22 ft. in height. Electric light wires must always be under other wires. Crossing and house-top wires must be at least 4 feet above electric light wires. Only one line of poles is allowed on the same side of the street. None are allowed in front of doors or windows. Preference is given to street corners and property lines, chestnut poles (not over 16 in. in diameter at the butt) are used by the Electrical Department when they can be obtained.

Appropriations for public lighting by electricity (which is very slow to take the place of gas here) are now made to the Electrical Department which makes contracts for the service with several companies, allowing them the use of the city poles. Daily reports are made by the police as to the failure of lamps, and a deduction from the payment made for all which do not burn eight hours.

Underground Wires.—In June, 1882, an ordinance was passed directing the removal of poles and wires from the streets by the first day of 1885, but very little attention was paid to it. In June, 1885, all telegraph and telephone companies were notified to remove all their overhead wires within the limits of the old city before the first day of 1886—with like effect. However, considerable progress seems now to be making in the direction of these ordinances. The Electrical Department has this year buried two miles of electric light wire and nine miles of telegraph wire in cables known as the "Standard" (Waring's patents) laid under the sidewalks in small (2 in. × 3 in.) wooden box conduit filled with roofing pitch—about a mile in length. The wooden box, being designed only as a mold to keep the pitch around the cables until it hardens, is not treated in any manner for preservation. It is proposed to extend this method with the city wires (including electric light) as rapidly as money can be obtained.

The Philadelphia Sectional Underground Company have about a mile of cast-iron conduit, 11 in. × 15 in., divided into eleven compartments for cables, and containing (at the first of this year) eight lead covered conductors of a total length of 23,602 ft., all of which are used for electric lighting. These conduits are laid two feet under the surface, a few feet outside the curb, with iron manholes and working chambers at every street crossing, and 10-in. circular handholes in front of every property.

Several other companies have laid underground wire by different methods—a total, on Jan. 1, 1886, of over 340 miles (in about 6 miles of conduit)—but only a small portion of it—22 miles of wire—was then reported as working.

Permits for additional poles and wires for telegraphic and telephonic purposes have not been granted since 1884, though probably some wires have been strung without.

The total number of poles on the highways of the city (exclusive of those along railroad tracks) on Jan. 1, 1886, was 8,508, of which 3,686 belonged to the city. At the same time there were 4,906 miles of overhead telegraph and telephone wire, and 157 miles of electric light wire.

(TO BE CONTINUED).

Simple Method of Tracing the Joints in Elliptic Arches.

M. MAURICE D'OCAGNE, in *Les Annales des Ponts et Chausseés*, gives the following simple method of tracing the joints in elliptic arches:—

Let m^1, m^2, m^3 . . . m' (Fig. 1) be points in the quarter ellipse $A\ B$ on which it is required to trace the joints normal with the ellipse. The tangents to

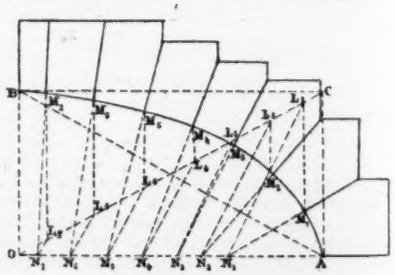

FIG. 1.

the points A and B, intersect at C; we then draw the lines $A\ B$ and $O\ C$. The perpendiculars to $O\ A$, dropped from m^1, m^2 . . . m', cut the line $O\ C$, at the points L^1, L^2, L^3 . . . . L'. The perpendiculars to $A\ B$, carried from the points L^1, L^2, etc., cut the line $O\ A$, at the points N^1, N^2, N^3, . . N'. Then the lines $M^1\ N^1$, $M^2\ N^2$, etc., are the normals sought for.

The proof of this method is very simple. Let $M\ N$, (Fig. 3) be the normal to an ellipse at the point M. From the point N, we draw towards $A\ B$, the perpendicular $N\ L$, cutting the ordinate $M\ P$, at L.

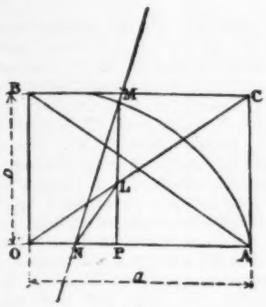

FIG. 2.

We now have by a well known property of the ellipse the equation.

$$\frac{PN}{OP} = \frac{b^2}{a^2}$$

The triangles $P\,L\,N$ and $O\,A\,B$, having their sides perpendicular to each other, we have the equation—

$$\frac{PL}{PN} = \frac{a}{b}$$

Multiplying these together we have

$$\frac{PL}{OP} = \frac{b}{a}$$

which demonstrates the fact that the point L, must be located on the line $O\,C$.

A New Self-Penetrating Grapple.

The device here illustrated, and recently patented by Mr. JAMES H. LANCASTER, 187 Broadway, N. Y., has for its chief purpose the construction of a digging and grappling machine that shall be compact, strong in all its parts and consequently durable and not likely to get out of order, and finally shall be self-penetrating into the material to be dredged and absolutely fill its bucket.

Referring to Fig. 1, the main lever-arms B, carrying the scoops, are grouped about and fulcrumed to a central ring A; the upper ends of the arms f, cross and overlap each other, each arm being attached by linked eye-bars b, to a central cap I; to the latter

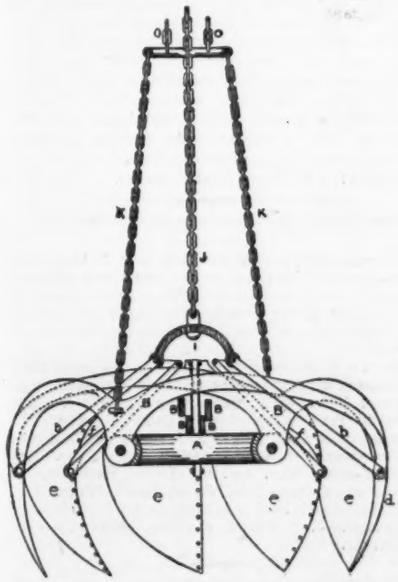

Fig. 1.

the hoist-chain J, for closing the grapple, is secured by a swivel. As will be seen from inspecting Fig. 1, as soon as the central cap I is lifted by the chain J, the power so applied, multiplied by the leverage, moves the points of the scoops b, downward and towards the center, thus positively digging and enclosing whatever material is being handled. When the grapple is closed, as shown in Fig. 2, the lever-arms become almost vertical and the strain upon them is very nearly tensile only. The load is then hoisted practically by both sets of chains J and O, by keeping them equally strained. To open the grapple and discharge the load, the hoist-chain J, is slackened and the load thus transferred to the opening chain O; as the grapple is then sustained, through K, by the outer set of link-bars attached outside of the fulcrum-ring, the weight of grapple and load combine to open the scoops.

The simplicity of this device is obvious, and the advantages of the improvement may be summed up as follows:

(1) That greater leverage, clutching, digging and penetrating force is obtained with the same power and time expended; and it may be operated by one man.

(2) That for the same cubical capacity of grapple, when working in hard material, it fills more completely at each cut, insuring against loss of power and time in handling partially filled buckets.

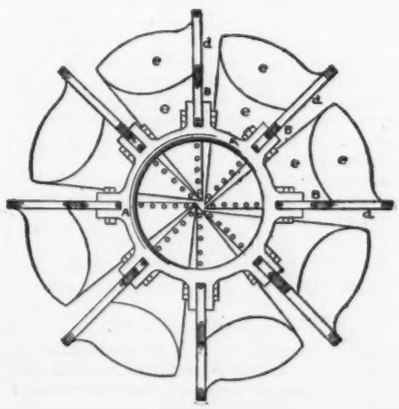

Fig. 3.

(3) That one form of this grapple will do a great variety of work and can be operated by one hoisting engine.

(4) The weight and vertical height of this grapple is considerably less for a given capacity, saving power in handling and head-room for boom or derrick.

(5) That when the grapple is open the teeth are well below all other parts and are thus ready to surround and grasp boulders, etc.

(6) That unlike all other forms of grapples the maximum leverage and clutching power of this bucket is in action just when required, *i.e.* when penetrating and enclosing the substance to be dredged. When closed and filled the hoisting chain transmits

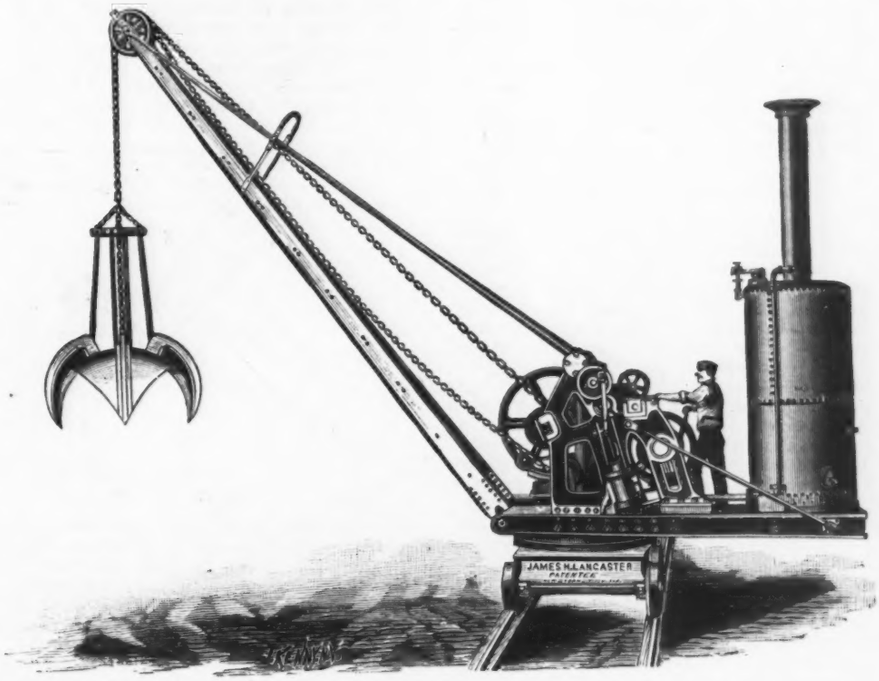

Fig. 4.

almost a tensile strain to the lever-arms and obviates liability to breakage.

For raising rock, wreckage, cargo, etc. the fulcrum points on the ring are made to shift around so as to allow the scoop to avoid obstacles and prevent jamming. These grapples are made of steel and with 4, 6 or 8 arms according to use. The type illustrated is designed for handling minerals, mud, clay, gravel, hard-pan rock, phosphates, fire-clay, etc.; and can also be used for loading and unloading vessels with sand, coal, grain, etc., or in handling ore or the debris from blast-furnaces.

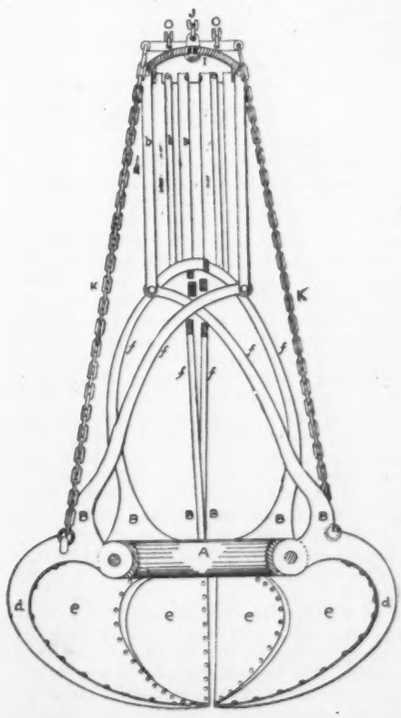

Fig. 2.

This improved grapple is now being supplied to the Bay State Dredging Co., of Boston, for work on the Calf Pasture in that city for the Beacon Construction Co., and quite a number are being constructed for use on the public works of New York City. A Honduras dredging company is also about to apply it to the recovery of auriferous sands and gravel from the bottom of rivers in that country.

Figs. 3 and 4 show a plan of the grapple open, and its application to a moveable derrick platform; the latter form adapting it to number of useful purposes which will suggest themselves to the engineer.

The Mt. Pilatus Rack-Railway.

The latest rack-way in Europe is the one now nearly completed for the ascent of Mt. Pilatus, near Luzerne in Switzerland. The maximum gradient is 48 per cent. and the total length will be very nearly 2.8 miles. The problem has been worked out by Messrs. LOCHER & Co., of Zurich, who had previously conducted extended experiments at the Swiss Locomotive Works upon which the final designs were based. The following description is taken from a paper read by J. Weber, manager of these works, before the Technical Society of Winterthur:

The peculiar feature in this new road is the use of a double vertical rack with two horizontal spur-wheels gearing into it. The roadbed is also very different from any now in use. Owing to the requirements of the gradient and service expected this permanent way is of masonry throughout its whole length, with ties of ⊔ iron rigidly anchored to the stone-work by long U-bolts passing through or under a large mass of masonry. The ties are placed 4.29 ft. from *c.* to *c.*, but where the rack and the rails are jointed, the ties are only 14.8 in, from *c.* to *c.* The gauge is 2.52 ft. (800 millimetres), and the rails are secured to the ties by angle and channel iron fastenings riveted, as is also the central longitudinal Vautherin rail, to which latter the double rack is firmly bolted, as shown in the figure. The rack is cut out of a solid steel bar in sections 10 ft. in length, (3 m.) The horizontal curves have uniform radii of 262.4 ft. (80 m.) and the vertical curves radii of 1,640 ft. (500 m.)

The engine differs from all previous designs, forming one vehicle with the carriage itself, the frames of both being in one piece. The boiler, of the ordinary locomotive type, is placed across the rails so that the incline will have little effect upon the water level. The whole vehicle is very light, weighing 6½ tons empty and 10.5 tons loaded with thirty-four passengers. The general dimensions in metric equivalents are as follows: Heating surface in boiler, 20 sq. m.; grate surface, 0.375 sq. m.; water capacity in boiler, 700 litres; in water tank, 800 litres; of coal tank, 350 kilos.; ratio of velocity between engine and spur-wheel, 3.8; effective horse-power, 67; diameter of spur-wheels gearing in rack, 405 millimetres; pitch, 86 millimetres; diameter of wheels on rails, 0.4 m.; wheel base, 6.1 m. The speed obtained on trial trip was 2¼ miles per hour, both up and down grade. There are three brake devices. (1.) The engine brake, manipulated by the foreman; (2) the worm-wheel brake under control of the guard, and (3) an automatic mechanical brake* which comes into action as soon as the speed exceeds one metre per second. To provide against wind-pressure, there are four spurs acting sideways against the railways.

The first engine built has been used for transporting the material for building the roadbed, suitable stone not being found on Pilatus. In November last, when Mr. Weber read his paper, 1640 lin. ft. of the line were completed, and it is expected that the whole line will be open to tourists for the season of 1888.

An investigation into the reasons which have in this new road apparently lead to a radical deviation from past practice, may not be without interest to our readers. We therefore give below a communication from Otto Grüninger C. E., of New York, whose long experience and intimate knowledge of rack-railways qualifies him to speak as an expert.

It is a well known fact that the tractive power of an ordinary locomotive depends very greatly upon the weight on the driving wheels; but when we note the deep interlocking of substantial steel teeth with a modern rack railway it might appear, that in this case the amount of possible tractive force was independent of the weight on the pinions. Practically this is the case, even for very steep inclines; but when we attempt gradients of 2200 and more feet per mile, as in some parts of the Pilatus railway, we find that this weight on the pinions becomes a very important factor, requiring careful study.

In investigating the problem presented it will simplify matters to assume that there is only one driving pinion and one tooth of the pinion in contact with the tooth of the rack-rail, and that consequently the whole tractive force is brought to bear upon the one point of contact (See Fig. 2). In this sketch, $r\,r$ is the inclined plane forming an angle x with a horizontal; A is the point of contact; $s\,s$ represents the tangential surface in the point of contact, and b is the angle made by this tangent with the incline.

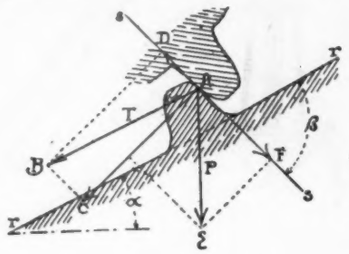

Fig. 2.

The tractive force T, due to the entire weight of engine and train, acts parallel to the inclined plane and is represented by the line $A\,B$. This force T resolves itself into a normal pressure $A\,C$ against the surfaces in the point of contact, and into $A\,D$ acting in these surfaces themselves; it is this component $A\,D$ which establishes a tendency in the pinion to slide out of gear. And this tendency is counteracted by the weight on the pinion, including also its own weight $A\,E = P$, the sum of the two; then, by again resolving P into components normal and tangential to the elements in contact, we have in $A\,F$ the force which directly resists the objectionable component $A\,D$; and, without regarding the frictional resistance in the point of contact, we may assume that as long as $A\,F$ is larger than $A\,D$ the pinion can not possibly leave the gear.

But the friction of the surfaces modifies these conditions. Friction always acts *against* the direction of motion: and there are now two distinct stages of the relative motion of the teeth during the completion of contact between two teeth. In the earlier stage of contact the pinion tooth slides *inwardly* towards the tooth of the rack, and then this relative sliding motion changes as the pinion tooth *withdraws* from the rack. Consequently, the friction at first assists the force $A\,D$, and thus diminishes the effect of $A\,F$, but later it assists the force $A\,F$. As the former of the two cases is the most unfavorable, it is indispensable to keep the pinion always properly in gear that we provide that the component $A\,F$ be always larger than $A\,D$ *plus* the friction of the teeth.

The angle $D\,A\,B = b$. Now by geometrical relations the angle $A\,E\,F = b - x$; we consequently have the equation.

$$D\,A = A\,B.\ cos,\ b = T.\ cos\ b$$
$$A\,F = A\,E.\ sin\,(b - x) = P.\ sin\,(b - x)$$

The normal pressure, $A\,C$, in the point of contact, A, is

$$A\,C = A\,B.\ sin\ b = T\ sin\ b.$$

(The normal component of P is already included in $A\,C$, because the traction T, corresponds to the total weight of engine and train, and therefore contains that portion which would be due to the weight on the pinion). Calling f, the coefficient of friction of the two surfaces, then the amount of friction is

$$f.\ T.\ sin\ b$$

The condition then to keep pinion always in proper gear, can be algebraically expressed as follows:—

$$P\ sin\,(b - x) > T.\ (cos\ b + f\ sin\ b)$$

The driving car on the Pilatus railway when fully loaded and in working order weighs, 10.5 tons (Eng.), or 23,520 lbs. On the maximum gradient of 1 in 2.31, this gives a traction due to gravity of a round 10,200 lbs.; adding 250 lbs. for frictional and curve resistance, we have a total traction of T = 10,450 lbs. The weight P, on the pinion we can estimate at 15,500 lbs. The angle x, for an incline of 1 in 2.31 is in round figures 25° 40'. The angle b, depends upon the type of gearing selected. On the Mt. Washington railway, for instance, a cycloidal gearing is used and in such a case b has varying values in the different stages of contact. In applying the above formula to that road, the smallest value of b should be selected as a basis of calculation. In all the subsequent European rack railroads, including the latest and most important form, the "Abt system," involute gearing has very properly been adopted. With involute gearing the teeth of the rack have straight, more or less, inclined faces, and in this type b has throughout the whole time of contact a constant value. Reasons, which it would carry us too far to explain here, have established a conventional value of 75° for b, though different writers vary this value slightly.

As the teeth of rack and pinion are always well greased, the co-efficient of friction may safely be taken at one-tenth, or $f = 0.1$; but to cover cases of insufficient lubrication we may fix it at 0.25, which give us a greater margin of safety. Introducing these values in the formulæ given we obtain

$$P.\ sin\,(b - x) = 15{,}500.\ 0.759 = 11{,}765\ \text{lbs.}$$
$$T\ (cos\ b + f\ sin\ b) = 10{,}450\ (0.259 + \frac{0.966}{4}) = 5225\ \text{lbs.};$$

that is 11,765 lbs. against 5,225 lbs.

If therefore the ordinary form of rack-rail, with a vertical pinion, had been adopted on Mt. Pilatus there would still have been an abundant margin of safety against the pinion leaving gear. Under regular conditions of proper lubrication, $f = 0.1$, the figures given would become 11,765 lbs. against 3,710 lbs.; and by deviating from the convential form of involute gearing by increasing the angle b, they may be made to contrast still more widely.

In a rack-railroad as adopted on Pilatus with opposite *horizontal* pinions, the tendency for the pinions to leave gear is met by the strength of the pinion shafts and of the engine frame; the weight of the vehicle in no way enters into the problem. This may be favorable when we reflect upon the tendency of strong and sudden gusts of wind to overturn the car. But as special mechanical provisions are made for just such emergencies, as on all rack-railroads, which act only when necessity calls them into action, and absolutely prevent any rising of the pinion from the rack, it is rather difficult to understand why a special type should have been here selected. The conditions of the problem certainly do not demand it, and the change has unquestionably lead to a very complicated engine.

*[There are excellent grounds for stating that this automatic brake was suggested to Messrs. LOCHER & Co. by their personal friend and fellow engineer, OTTO GRUNINGER, C. E., of New York. Mr. GRUNINGER had proposed a similar system as long ago as 1869 to the engineers, who shortly afterward built the first Rigi railroad; and had it been then adopted, the accident of 1885 on that line would undoubtedly have been prevented.—ED. ENG. NEWS.]

The Pawtucket Manufacturers' Exhibit.

The manufacturers of Pawtucket, R. I. have been having an exhibition of their own, and a very successful one it was. Our correspondent sends us notes of the exhibits of the prominent manufacturers whose goods have more or less of an engineering interest, as follows:

THE WM. H. HASKELL Co., a very fine display of bolts and nuts of all descriptions, wrought-iron chain with punched links, drop forgings, washers, etc. NEW AMERICAN FILE Co., an extensive and varied display of all manner of files. HENRY F. JENKS, sidewalk-drinking fountains, drilling and tapping machine, etc. THE A. E. TENNEY MAN. Co., the Draper water-motor, Draper steam engine, etc, JAMES DAVIS BELTING Co., single and double leather belting, round twist belting, lacing, etc. J. S. WHITE, shafting, hangers, sewer-covers, etc.

A LITTLE item indicating what an enormous and increasing burden terminal expenses are to railways, is visible in the last report of the Cincinnati Southern (Cincinnati, New Orleans & Texas Pacific) Railway. Out of a total operating expense of $1,753,879, no less than $124,780, or over 7 per cent. was for *an increase* in terminal expenses, occasioned by the want of sufficient depot and yard accommodations. The average earnings per mile having been $5,220, this *abnormal increase* of terminal charges was equal to the average cost of operating 24 miles of road, and to the total additional cost of operation, which would have arisen from 80 or 90 additional miles between termini. Yet this road is rather favorably situated in respect to terminal expenses, compared with dozens of others.

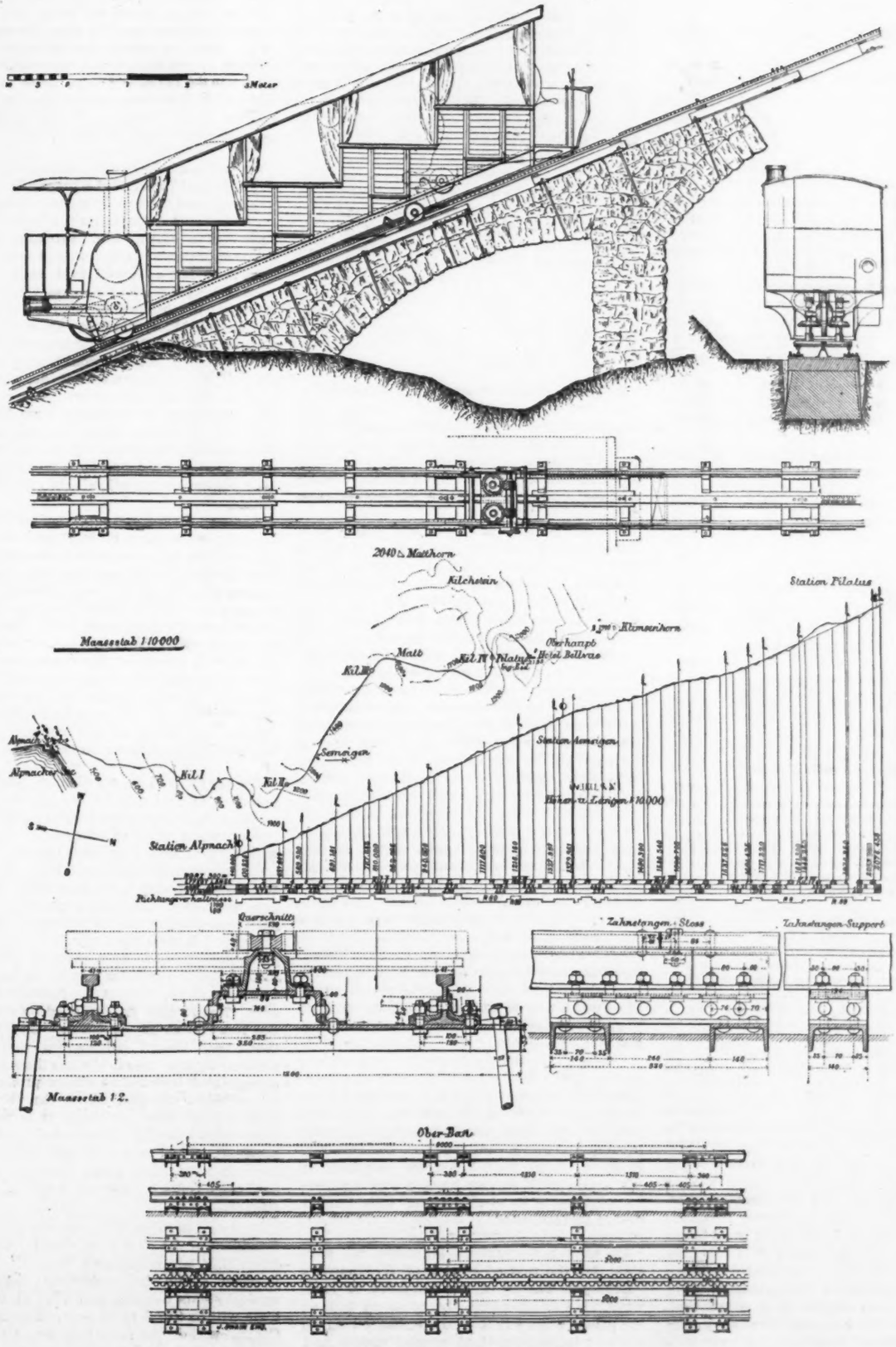

Fig. 1. Double-Rack Railway: Mt. Pilatus.

ENGINEERING NEWS

AND

AMERICAN CONTRACT JOURNAL.

TRIBUNE BUILDING, - NEW YORK CITY.

VOL. XVII. Saturday, February 19, 1887

D. McN. STAUFFER. A. M. WELLINGTON.
EDITORS.

GEO. H. FROST, - - - BUSINESS MANAGER.

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New Advertisements this Week.

The Bagnall & Loud Block Co. Pumps, Boston, Mass.
Albert Lucius. Engineer, New York City.
Bourbon Copper & Brass Works. Salesmen Wanted, Cincinnati, O.
A. L. Howe. Water-works bids, Natchez, Miss.
Water-works, Superintendent Wanted, Providence, R. I.
J. T. Dodge. Railroad construction, Helena, Mon.
Albert B. Hill. Sewer proposals, New Haven, Conn.
Lieut. Col. Wm. E. Merrill. Engines Wanted, Cincinnati, O.
J. C. Saxton. Engines for Sale, New York City.
Wants. Pages V and XII.
Proposals. Page XII.

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ONE of the disadvantages of the profession of engineering is that engagements are so apt to be temporary, and its members such professional vagabonds. A lawyer or architect or doctor "plants" himself in some town, and if he does not get ahead it is his own fault. But few engineers can do this. They may say in literal truth, "THE WORLD is mine oyster," and it is so very large an oyster that very many suffer from the fact that they cannot be on all sides of it at once, by never succeeding in getting outside of it.

We have this difficulty constantly brought before us by alternate applications of men needing engagements and men with positions to fill. In England this difficulty is met by the very general practice of advertising the fact of vacancies, even when (as we have reason to know) it is fully expected to fill the position with a candidate already known, because of the possibility that a candidate *may* turn up better qualified in every way, and in greater need. Not those who have the keenest scent for finding engagements, by any means, are the best qualified to fill them. Many an able or promising man lacks that peculiar faculty, perhaps from the very fact that he is more faithful to the duties before him.

The English practice has never yet become common in this country, and it is much to be regretted. To do what we can to establish it, in the common interest of the employers and employed, we have determined to publish hereafter all notices of positions vacant FREE, as announced at the head of our columns. We hope the offer will be generally availed of, as justice and fair play demand. The great American motto is LET THE BEST MAN WIN. We have done our part to insure this. We trust our readers will do theirs.

A letter to the *Herald* from Mr. WM. P. HUNT, President of the South Boston Ironworks and the maker of some of the heaviest guns now in our service, proves either that some one is badly mistaken as to relative values of steel and gun-iron as used in modern ordnance, or that cast-iron is not having a fair trial in that direction.

Mr. HUNT says that the United States now has a 12½-inch cast-iron gun converted into a rifle and made ten years ago; that this gun has been fired with 200 lbs. charges of hexagonal, or quick burning powder, and is still serviceable. The government has another experimental 12-in. rifle made entirely of cast-iron which has been fired more than 100 times with 265 lbs. of powder and 800 lbs. projectile, and the gun is still serviceable. Mr. HUNT remarks that some of these converted guns have been fired under pressures fully three times as great as would be considered safe for a Krupp gun of the same calibre, but twice the weight, and have stood the test unharmed.

The writer very pertinently asks why these guns are laid aside, and not tested to destruction so that the country may know what cast-iron is equal to under the most severe service tests? Mr. HUNT has offered to construct, at his own cost, one 12 in. mortar, one 10 in. rifle and one 8 in. rifle, breech-loading and high power, of the U. S. Ordnance Department's standard weight and dimensions, and deliver them for test on the sole condition that if they should endure 200 high service rounds, such as are adapted to steel guns, the Government shall pay for them and order others at half the price of steel guns of the same power and size.

This is a fair and business-like proposition, and we doubt very much the receipt of a similar offer from any foreign maker of steel guns of like calibre, especially as to the number of test charges. Just now we want guns, want them quickly and want the best. But with Mr. Hunt we think that American cast-iron or cast steel should at least have a fair and exhaustive test of its merits along with foreign design and material.

IN answer to various inquiries, we may state that the revised edition of Wellington's "Economic Theory of the Location of Railways," is going through the press as fast as the printers can put it through, but owing to the very large amount of tabular matter and cuts, it is impossible to push it as fast as if it consisted merely of text. The volume will contain upwards of 800 pages, instead of 600 as announced, with upwards of 200 tables and nearly 300 cuts and plates, making it the most elaborate technical work which has ever appeared in this country, Trautwine's Pocket Book alone excepted. The tables, with a few partial exceptions, have been specially compiled or computed for the work, and are not to be found elsewhere. It will take nearly 1000 copies to fill the advance orders which have already been received, and our readers may be assured that there will be no unnecessary delay, and that the date of publication depends wholly on the printers. It will probably be out towards the end of March.

SINCE the late horrible accident on the Vermont Central Railroad, the press of the country has contained the usual number of suggestions for the "sure prevention" of future occurrences of a like nature. Probably the most original of these is a letter from a correspondent who is "amazed" that railroad trains should be allowed to run on the "top" of bridges. He thinks that this type of structure (*i. e.* deck bridges) should be abolished by law, as he is assured that the "heavy iron sides" of a through bridge would keep a single derailed car, or "even a whole derailed train," from going into the river. The correspondent's final statement that—"I am not a civil engineer as you may infer, and you may overestimate the importance of what I have long thought to be a most strange oversight in railroad bridge construction"—is entirely superfluous.

Another doctor gravely recommends that all railroad bridges be built with a hump in the middle, by adopting gradients starting about 30 feet from either end and meeting at the center. He indulgently explains that this angle of intersection should not be sharp, but rather have "a slight bow." His claim is that the cars would be more securely "weighted to the rail" in ascending the grade; and that the increasing tendency to greater speed on going down the opposite grade "holds direction." Some further bits of wisdom relating to the inevitable settling at the center of "level bridges" are on a par with the matter quoted.

WE are pleased to note in the *Sanitary Engineer* a careful article on the car-heating question taking substantially the same view of the question as is expressed in our article, which was crowded out from last week's issue, and consequently appears in this. To some of the details of our contemporary's article we can not agree. Average locomotive practice does not require an allowance of 40 lbs. of steam per horse-power per hour, and on the other hand no car can require as much as 100 lbs. of steam per hour to heat it, nor hardly half that as experiment has indicated. Moreover 17-car trains hardly need be considered nor more than 12-car trains. But even with these very liberal allowances our contemporary's figures amount to less than 5 per cent. of the total locomotive steam production, or 0.4 per cent. per car, which can be supplied with perfect ease, although it is more than double the quantity which would probably be required. Even some of the railroad trade journals have taken a very decided position to the same effect. Others keep a discreet silence.

As we go to press it is announced that the President of the New York Central & Hudson River R. R. has withdrawn from the extreme position which he somewhat rashly took against steam heating, and that at least one train will be fitted up at once. The Michigan Central will do the same thing, and a number of other roads are less definitely reported as intending to do so.

WHETHER or not severe cold weather tends to render iron and steel more brittle, has been

for years a subject of dispute. The burden of experimental evidence is that it does not. The burden of popular belief is overwhelmingly that it does. Other things being equal, the experimental evidence should be accepted, and very many engineers have probably done so, but we have been shown lately a chart (which we cannot yet publish as it is not yet quite as complete as is desired) which indicates in the most positive way that popular belief is right, and that the alleged experimental tests are wrong, probably from some failure to reproduce exactly the conditions of service, which is so common a defect of tests.

This chart shows for each day of a considerable period past, *first*, the average temperature of each day, as returned by the signal service, and *secondly*, the number of the broken rails reported on that day on a great railway system. Each gives a more or less saw-like profile, and the resemblance of the two to each other is something very extraordinary. There are of course irregularities and discrepancies, but in the main the moral is clear, that each degree of difference of temperature meant another broken rail or two somewhere on the system, and each 5° or 10°, five or ten times as many.

Such evidence, granting enough of it, is worth any amount of laboratory testing, because there is no possibility of error in the conditions or assumptions. The common explanation of the great excess of rail and axle breakages in winter is that the frozen roadbed has an anvil-like effect which is intensified by irregular bearing. It is reasonable that this should have great effect, but the ground once frozen, the daily fluctuations of temperature, which we all know are extreme, can have no further effect in this way; and since the records referred to prove all but absolutely that these daily fluctuations do have great effect on the number of breakages, it is difficult to escape the conclusion that the effect of temperature on the brittleness of metal is direct and important.

WE see it stated in a railroad paper of this city that:

"The fastest train on the New York Central runs from New York to Buffalo, 440 miles, in 10 h. 45 min., or at the rate of 40.93 miles per hour. *This can be done because the grades are remarkably favorable, and the stopping stations average no less than 110 miles apart.* The Pennsylvania runs the limited express from Jersey City to Pittsburg, 443 miles, in 11 h. 17 min., corresponding to a speed of 39.27 miles per hour, *the average distance between stoppages being 110¼ miles.* The speed is fully 1¼ miles slower than on the New York Central, *showing the effects of the more unfavorable grades and curves.*"

Our contemporary has jumped too quickly to a conclusion. The "unfavorable grades and curves" have nothing to do with this difference, and still less the distance between stops, as to which the statement is a little mixed. The difference is due to the much simpler fact that the Pennsylvania is the short line to Chicago, and the New York Central must run faster to make the same through time. We know of no road in this country which has ever consented to make slower time because of its alignment.

EIGHT or nine years ago three young engineers were connected with the mechanical department of the Pennsylvania Railroad, in pursuance of the policy, in which that road is almost alone, of having quite a staff of young men of promise in its service at small salaries, in training for higher positions if they develop fitness. The phenomenal rise of two of them is recorded in our personal column. The third one, and the youngest of all, Mr. E. B. WALL, has been for several years Superintendent of Motive Power of the Pittsburg, Cincinnati & St. Louis. Their career should teach young men two valuable lessons: that engineers are preferred more and more for the prizes in official positions, if they have shown qualities in junior positions to fit them for advancement, and that what a man is learning and whom he is serving under is of far more importance to him than what pay he is drawing. Few levellers and no railroad conductors would have envied these still young men the salaries they were receiving when they began laying the foundation of their present success, and when the prospect for early advancement did not seem brilliant; but "All things comes to them who knows how to wait," and who merit receiving them.

THE Boston Water Board, as at present constituted, is evidently not happy in the possession of the 4,000 Tremont water meters, which were one time so energetically backed by a former chairman of the same board. The board is now advertising that it will commence, sometime in next April, a public competitive test of water meters; and all indications point to a fair test, open to all reputable makers who will signify their intentions before March 1.

The Question of Car Heating.

"The blood of the martyrs is the seed of the church," and to be effective it seems to be necessary that they should die a martyr's death. It is more so now than formerly. The ordinary horrors of the world are served up in such numbers with our breakfast that we take them in not so very different a spirit from an "antique Roman's" at the amphitheatre, and for much the same reason; custom has dulled our sense of pity. Only in this way can we explain the indifference of the public to the annual car-coupling slaughter, which is rather worse than a Woodstock disaster every week, not to speak of some little questions of sewerage and plumbing.

But when the public are waked up by sufficiently startling calamities they feel deeply enough, and the series of holocausts which have followed each other in quick succession this winter, and culminated at Woodstock, have moved it deeply, and started a loud and earnest public demand which is more than likely to bear permanent fruit in a gradual change of our system of car-heating.

Three fire disasters of the first rank, at Rio, Republic, and now at Woodstock have happened within the past few weeks, with two other less serious ones in between them, and pathos can no further go than in some of the scenes at each of these, and especially the first and last. And as railway managers are only men of like nature with ourselves we may be sure that they have been as deeply moved as the public, although they do not say so much about it, and are far more ready than before to listen patiently to inventors of steam heaters.

It is proper that technical journals should be very cautious in giving voice to such popular clamor, which often is utterly unreasonable, and dies out as quickly as it arises, but for once the public is exactly right in its demand, that fire on cars can and should be done away with altogether, and technical journals should not fear to say so. That it should be done immediately and universally, as so many of the papers demand, would not be reasonable, for although there are at least three systems for heating by live steam from the locomotive, the Martin, the Gold, and the Emerson, which are doing work satisfactory to those using them, and have been for some time in use on a number of trains (the Martin and Gold very extensively) yet it is not probable that either one of them has assumed what will be its final and best form, nor is perfectly adapted for all contingencies. A mere choice between these systems requires time. But we do not envy that railway manager who may chance to have a car-load of passengers burned up a year from now, and who is not able to show that he has at least made experimental start in this direction; and if it were made unlawful for any train to be run with fire on the cars after a period of five years—and possibly for certain classes of trains after a somewhat shorter time—we anticipate that no very serious difficulty would arise in finding a system within that time which would be sufficiently satisfactory, and at least as economical as the heaters now in use, and probably more so.

The present status of the problem, as an engineering question, may be summarized thus: The direct objections to the practibility of the system are (1) the question of steam supply and (2) the difficulty of distribution. Collateral practical objections are (1) that cars cannot be heated before the locomotive is attached, which is rarely done now until the moment of starting, (2) that cars taken on *en route* cannot be heated, and (3) that a train stuck in a snow-bank or left without locomotive in some exigency, or in long stops at division stations, cannot be heated.

As respects the last point, tests on the New York elevated cars (Gold system) have shown that sufficient heat is stored in the pipe filled with brine, by which the steam pipes are surrounded, to last for an hour easily, or without positive discomfort for two hours, when the thermometer is not below zero. This storage plan works with entire success on the New York elevated, and enables a car to be left without steam for a long time, if the engine is detached or needs all its steam. As a matter of fact, however, shutting off steam because of scant supply is said by those who use these heating systems to be rarely or never necessary.

Cases when a train is stuck in a snow-bank are an admitted difficulty, but it would be usually possible to keep up steam in the locomotive, for heating purposes only. Cases when it would be impossible, for any length of time and at a dangerous distance from shelter, are so rare as hardly to make it worth while, for most roads, to make the temporary provisions for such exigencies which are obviously possible without any great draft on one's inventive faculties.

The difficulty of heating cars before the locomotive is attached is a real one and necessitates special provisions for supplying steam from stationary apparatus at the points from which trains or cars start. But with very few exceptions the station buildings at such points are of such magnitude as to now have, or warrant the use of steam apparatus for heating them, and there can be no real hardship in requiring it to be gradually introduced at all stations from which cars start. Cars as well as the buildings can then be heated from it by suitable hose connections. The heaters which are widely used for fire-engines are an already perfected device which might serve at small stations in default of something better. At very large stations, like those of our great cities, from which very numerous trains start, there would naturally be special car-heating arrangements outside of the station, making needless any steam connections whatever during the few minutes that most trains are receiving passengers.

In respect to the collateral objections to such a system, therefore, there is really nothing which can be regarded as a permanent obstacle. At least one great engineer, Mr. CHAUNCEY M. DEPEW, has recently taken a decided position to the contrary, but as he stated merely his belief and did not support it by evidence, we must feign believe that he has

not studied this engineering question with the same attention as others.

There remains then only the two questions of the locomotive steam supply and of its distribution. That the locomotive can supply without difficulty the necessary steam, or be made to supply it, is beyond all question. In saying this we do not take the extreme position which we are astonished to find in the *Railroad and Engineering Journal*, that it would take *less than one-half of one per cent.* of the ordinary locomotive steam supply to heat twelve cars. It will take far more than that. The error apparently arose from taking 12000 instead of 1200 square feet as the ordinary heating surface of a locomotive, which we should fancy to be a typographical error except that the context shows it was used as a basis for calculation, so that it was probably a two hasty draft on memory. The true quantity will be two to three per cent., as may be determined thus:

The amount of steam necessary to heat a car has been determined experimentally to be from 30 to 50 pounds per car, depending on its size and the weather. At an average of 40 pounds per hour, 480 pounds of steam per hour would be required, which at 30 pounds per horse-power per hour (an ordinary locomotive rate) would continuously draw off 16 horse-power of steam. There is no large number of locomotives which develope 3200 horse-power, as a one-half of 1 per cent. ratio would require, but an ordinary limit for passenger engines, as averages of long runs, is 400 to 600 horse-power, giving 2½ to 3½ per cent. of the total supply of steam as needed for heating. The same result in substance is reached by remembering that more square feet of grate surface an engine can comfortably burn 80 to 100 pounds of coal per hour, or 1,360 to 1,700 pounds, and computing the horse-power from that at 3 to 4 pounds per hour.

But allowing that 3 per cent more steam is demanded, it could be obtained (1) either by reducing the load 3 per cent., or (2) increasing the heating surface and grate area 3 per cent., or (3) decreasing the speed about 3 per cent., or (4) decreasing the loss by radiation from the unprotected fire-box plates and otherwise about 20 per cent., but it is practically unnecessary to adopt either of these simple expedients because:

(5) The engine is half the time going down grade or on a level when the fires are not pushed. It is only necessary to push the fires at these times a little harder. (6) An enormous proportion of the time of even the fastest express trains aggregating from one-fifth to one-third, is spent in stops, when the engine is doing no work, and can spare steam as well as not.

Therefore, although at first sight it seems reasonable and almost self-evident that a fast passenger engine cannot spare steam for heating cars without serious disadvantage, yet when we look into the question a little more carefully we find no rational grounds for the claim that passenger engines cannot supply all necessary steam with ease. Railroad officers and engineers who assert the contrary will we fear be putting themselves on record in as way they will have cause to regret, because not only may it readily be shown from known facts that it can be done, but it *is* done continuously by some hundreds of locomotives in this country, and always with ease.

There remains only the question of distribution, and that is a question of fact. The fact appears to be that the difficulties of detail have been overcome sufficiently well to satisfy those who are already using steam-heaters and on quite a large scale. The obstacles to perfection may still be great, but they have been so well overcome in at least two systems as to make it practically certain that better in time can be done if necessary. Evidence as to this point which we cannot now go into is, we think, conclusive.

Three years ago, or even two, so much as we have said would hardly have been warranted, but since then enough progress has been made to justify and require technical journals which are such in fact to speak out boldly in defence of the popular demand for safer heating of cars, which in this case has reason and justice on its side.

Young Men and the American Society of Civil Engineers.

We give in another column a letter called out by the statistics of the growth of the American Society of Civil Engineers, which appeared in our issue of Jan. 29, which presents a view which we fear is too common among the younger members of the profession. It needs no very shrewd guessing to interpret the signature "Y. C. E," as meaning "young civil engineer," and he claims that, to put it frankly, it costs more than it comes to for a young man to belong to that Society, especially if he does not live in New York, where its regular monthly meetings are held.

Thirty-three and a third per cent. of our correspondent's argument is done away with at once by his mistake as to the annual dues, which are only $10 per year instead of $15, but that he takes a view which is too common for the good of the Society is evident from the fact that there is so small a proportion of Juniors, only 106 against 760 Members last year, when it was larger than ever before. In view of the fact that there are in the whole body of the profession at least three or four men who are qualified for the grade of Junior for one who is qualified for the grade of Member, the fact that there were 59 Members, to only 17 Juniors admitted last year, indicates that there is at least ten times as much disposition in the higher grades of the profession to join the higher grade of the Society, as there is in the junior grades of the profession, to join the junior grade of the Society.

To put the same fact in another way; whereas in the general practice of the profession every one who reaches the standing which qualifies for membership, comes up through the grades of experience which qualify a man to become a Junior of the Society, in the accessions to the Society's membership, there were only 6 out of 59, or about one-tenth, who became Members by promotion from the junior grade.

This is unfortunate, and it seems to us something might and should be done to remedy it, for it is beyond doubt the wish of nine out of ten of the members that young men should connect themselves with the Society, and feel an interest in it, early in their professional life, rising to its higher grade as they advance in experience. But after all, if the question of joining or not joining such an organization were reduced to a mere question of utility, we fear that the membership of the Society in all its grades, and of all others as well, would be much smaller than it is. *Esprit du corps* should count for something. The desire to strengthen and form a part of a great representative organization of engineers should alone be enough to induce even a young man's lean pocket to spare $10 for the purpose, especially as he gets fair value for more than half of that sum directly, in the tranactions, with other privileges which he would appreciate better in the Society than out of it. And he can be certain that every man does strengthen it who joins it in any grade, and that the Society will never be so strong, but that it will be for the interest of the entire profession to make it stronger, being, as it is already, a truly national and representative organization in the distribution of its membership, and certain to retain and increase its lead.

But it is worth the consideration of the Society whether there be not some force in the point made by our correspondent, that the dues are disproportionately high for young men. It is in the first place always well to fit the burden to the back which bears it, and there can be no doubt that $10 per year is at least twice as great a tax on the average young man's pocket as $15 on the average member, while the disproportion of $20 and $25 in the resident dues is still greater. Again, the member pays his dues, which he can so much better spare, for privileges in the way of attending conventions and other meetings which he is in a position to avail himself of much more generally, and for what in effect is a certificate from his professional peers that he is in some one branch of his profession a skilled and competent man for responsible charge of work. This may be, as it often has been, of professional advantage to him. The young man pays his heavier proportionate dues for privileges which he will not, as a rule, be as well able to avail himself of, and for a certificate in effect that he is NOT as yet qualified for responsible charge of work. Does not the one man get a good deal more for his money than the other? It seems to us that he does, and that this accounts for the slower growth of the junior grade, although it should not be forgotten that young men are extremely likely to secure preference for vacancies, all other things being equal, from the mere fact of being a Junior of the Society. It works so in England, where even Students of the Institute (a grade below our junior) make a point of advertising that fact in the advertisements for employment which are so much more common there than here.

It may indeed be claimed that it is not desired nor intended that young men should come in to the American Society until they have had a fair amount of experience and are nearly qualified for membership, but besides the fact that we do not believe that to be the feeling o any considerable fraction of the Society, there is a certain obvious danger in such an attitude; that the young men who grow up through their earlier years with no interest in the Society may get to feel toward it much as DR. SAMUEL JOHNSON felt toward Lord CHESTERFIELD, as expressed in a once famous letter which will bear quoting for its literary merit alone:

TO THE RIGHT HON. THE EARL OF CHESTERFIELD.

MY LORD:

When upon some slight encouragement I visited your Lordship, I was overpowered, like the rest of mankind by the enchantment of your address, but I found my attendance so little encouraged that neither pride nor modesty would permit me to continue it.

Seven years, my Lord, have now passed since I waited in your outward rooms, or was repulsed from your door, during which time I have been pushing on my work through difficulties of which it is useless to complain, and have brought it at last to the verge of completion, without one act of assistance, one word of encouragement or one smile of favor. Such treatment I did not expect, for I never had a patron before. Is not a patron, My Lord, one who looks with unconcern on a man struggling for life in the water, and when he has reached ground encumbers him with help? *The notice which you have been pleased to take of my labors, had it been early, had been kind, but it has been delayed till I am indifferent and cannot enjoy it; till I am solitary and cannot impart it; till I am known and do not want it. I hope it is no very cynical asperity not to confess obligations, where no benefit has been received,* or to be unwilling that the public should consider me as owing that to a Patron which Providence has enabled me to do for myself.

Having carried on my work thus far with so little obligation to any favorer of learning, I shall not be disappointed though I should complete it, if less be possible

with less: for I have long wakened from that dream of hope in which I once boasted myself with so much exaltation. My Lord.

Your Lordship's most humble, most obedient servant,
SAM. JOHNSON.

The Quaker Bridge Dam.

In our last issue we briefly referred to the vote of the Aqueduct Commission (5 to 1) to adopt the majority report authorizing the construction of the Quaker Bridge Dam. Commissioner OLIVER W. BARNES, of the Construction Committee, presented the favorable report and therein recited the proceedings of the past several years in relation to this important work, showing that the subject had been carefully considered by such engineers—as Mr. ISAAC NEWTON, then Chief Engineer of the Croton Aqueduct; Mr. E. S. CHESBROUGH, Engineer of Boston Water-Works; Mr. BENJ. S. CHURCH, 26 years Resident Engineer in charge of the Croton Aqueduct; Mr. JULIUS W. ADAMS, long consulting engineer of the Department of Public Works of New York, and of very extended experience in the construction of water-works. The plans prepared under these gentlemen were then submitted to Mr. JOHN B. JERVIS, who designed and superintended the building of the Croton Aqueduct; JAMES B. FRANCIS, the eminent hydraulic engineer, of Lowell, Mass., and ROBT. K. MARTIN, the engineer and constructor of the Baltimore aqueduct and water-works. Other engineers have also examined closely into the matter and concurred in the report of the consulting engineers, viz.: Gen. GEO S. GREENE, for some time Chief Engineer of the Croton Aqueduct; G. W. BIRDSALL, Chief Engineer Department of Public Works, and ALPHONSE FTELEY, the engineer in charge of the Sudbury Water Supply of Boston, and now Consulting Engineer of the Aqueduct Commission.

We have gone into the above detail to show that the location of this very important structure, its value as an impounder of water, its feasibility and the engineering problems involved in its construction have all been fully considered, discussed and decided upon by the best authorities that this country can offer. Without exception, each engineer named has had long experience in the planning and construction of works of a similar character, and the majority of them have been directly connected with the Croton water shed and its utilization as a source of water supply, and are hence very familiar with controlling conditions.

Against this array of authority the minority report can only produce the evidence of citizens, who have neither the training nor technical knowledge necessary to discuss so important a technical question, and of engineers of whom Gen. NEWTON says "it is not known that anyone of reputation and experience in this branch of engineering has opposed the project." These opposing engineers certainly made some sad, but under the circumstances quite natural, blunders in the assumption of data and argument therefrom. The protests emanating from such bodies as the Union League Club, the Taxpayers and Business Men's Association, etc., can have no weight in such a disqussion; as the subject is one of a purely professional character and entirely beyond their comprehension. Moreover, similar reports are easily procured for or against any public project by a very small amount of energetic log-rolling.

The responsibility now rests where it belongs; with the best hydraulic engineers of the country, who thus set their professional reputation and experience against the irresponsible and unbased assertions of those who have only personal ends to serve, in either manufacturing notoriety or making political capital.

Annual Report for 1886 of the Department of Public Works of New York.

The following is a summary of the report of GEN. JOHN NEWTON, Commissioner of the Department of Public Works of New York for the year ending Dec. 31, 1886:—

Total expenditures for the year $3,514,915.31, of which $244,158.32 was for the unfinished contract for paving Fifth Ave. There were 196 contracts entered into during the year, of a total estimated cost of $1,826,381.49; the important ones being—49 sewer contracts, $363,026.39; 41 regulating and grading contracts, $477,114.14; 51 paving contracts, $757,306.00 and 6 water-pipe contracts, $110,559.20. There were 91 contracts completed in the year at an actual cost of $1,313,382.34.

In the Croton water-shed the average rainfall for the year was 49.88 in. According to a table given, the average rainfall in this region for 21 years was 46.80 in.; the lowest being 38.52 in. in 1880 and the highest, 52.80 in 1882. Notwithstanding that the actual rainfall for last year was above the average noted, 5,270 million gallons were drawn from stored water to meet demands. In the Bronx river water-shed the average rainfall was 43.84 in. in 1886; the average daily supply received from this source was 14,274,000 galls., or 107,000 galls. per sq. mile of water-shed; the city receives through the present Aqueduct only 30,000 galls. per sq. mile from the Croton water-shed, pointing out the necessity for increased storage and conduit capacity. The total cost of the Bronx river system to date is $3,297,638.79.

The distribution system in New York, now comprises 604.42 miles of pipes, with 6,284 stop-cocks and 7,833 fire-hydrants. There are 14,582 meters in use; 902 having been placed in the year; the various types being—7,292 Worthington, 7,262 Crown and 28 Gem meters; 23,106,100 galls. daily is thus measured. Rapid increase of population in the high service region has caused a daily increase in pumping of 900,000 galls. over the service of 1885, or 13,500,000 galls. per diem. Since 1881, the number of buildings in the high service district has increased from 8,607 to 12,249. Both the conditions of the water supply and the pumping capacity forbid further increase of consumption. Complaint is made of the great waste of water to prevent freezing of water pipes.

During the year, 42,507 sq. yds. of granite block, 31,988 sq. yds. of trap-block and 2,261 sq. yds. of asphalt pavement were laid; the aggregate length of new pavement being 4.95 miles, exclusive of Fifth Ave. On the latter 54,069 sq. yds. of pavement were laid. Of new pavements paid for by assessments, 1.29 miles were laid. The Department force relaid in repairs 234,249 sq. yds. of pavement and 714 cross-walks. South of Harlem river there now 364.49 miles of paved streets; 73.4 miles being granite-block; 226.25 miles, trap-block; 26.29 miles, cobble-stone; 27.77 miles, macadam and 0.78 miles, asphalt pavement.

In the past year, 4889 lin. ft. of sewers were built by property owners under permits. The sewerage system of Manhattan Island now includes 414.1 miles of sewers of all sizes; of these 56 miles are outlet and collective sewers, and the remainder lateral sewers. There are 5,077 catch-basins in the system. Mr. HORACE LOOMIS, Engineer in charge of sewers, in his detailed report gives some interesting data under the head of "repairs and cleaning." During the year about 14 miles of sewers were cleaned; 56,819 lin. ft. being brick and 21,000 lin. ft. were pipe sewers. The cost for cleaning the brick sewers was 39 cts., and the pipe sewers, 7 cts. per lin. ft. As the pipe sewers are mostly small branch sewers they must be flushed from one into another. The cleaning of the brick sewers is a costly and tedious process; the cost sometimes reaching 83 per cu. yd. of material removed; under the competitive plan, recently introduced, the average cost of cleaning brick sewers has been 29 cts. per lin. ft.

At the close of the year there were 21,194 gas-lamps, 711 electric lights and 120 naptha lamps in use in the City. The total length of streets lighted is 464 miles, exclusive of 42 acres of parks. The present length of gas mains laid is 927½ miles. By an estimate made for replacing gas-lamps by electric lights in certain streets and parks named by resolutions of Common Council, the excess in cost in electric over gas light was found to be $446,290 per annum.

The City revenue from water rents, penalties and permits was $2,358,121.11 for the year. The Department also collected from various other sources the sum of $107,924.94, mainly from vault and sewer permits.

Annual Report of Boston Water Board.

The eleventh annual report of the Boston Board has just appeared, covering the year 1886. Quoting from the general statistics, we find that for the Cochituate and Sudbury works the average daily consumption of water is 26,627,000 galls., or 74.3 galls. per head. There are 3,763 meters in use measuring about 24 per cent. of the water used. The length of supply and distribution mains is 414 miles, with 4,806 fire hydrants. The cost of these works to Jan. 1, 1887, was $18,973,616.03; the revenue last year from water rates was $1,206,064.69 and the cost of maintenance was $336,507.37.

For the Mystic supply, the daily consumption last year was 7,399,800 galls., or 72.5 galls. per head; there were 469 meters and motors, measuring 15 per cent. of the consumption; 133.2 miles of supply and distribution mains and 818 fire-hydrants. The cost of the Mystic Works to Jan. 1, 1887, was $1,657,458.97; the annual revenue from water rates, $249,609.62 and the yearly cost of maintenance was $134,439.43.

Under the head of Consumption, the report states that the organization of the system of waste detection in 1883 reduced the per capita daily consumption nearly 20 galls., or from 90 to 72 galls., by the Deacon meter and house-to-house inspection. While there has been no further decrease in average consumption the Board is satisfied that the continuation of the system in the last two years has prevented causes of waste and kept the consumption at a nearly uniform rate. The apparent slight increase in the last year must rather be charged to the business growth of the city than to "population" as such. It has been ascertained by repeated tests that in Boston the dwelling house consumption is less than 50, perhaps less than 40 galls. per head daily. But in a certain district of the city containing several large hotels, restaurants and places of public resort, and but a limited number of manufacturing establishments, the water delivered through meters alone is equivalent to 550 galls. per head to a census population of about 2,700; with the additional delivery this amounts to over 700 galls. per capita per day. The explanation is that this district provides every day for the personal requirements of, perhaps, ten times as many persons as actually live within it.

As the present daily supply is but 35,000,000 galls., and the estimated consumption in 1905, with 550,000 inhabitants, would be 41,000,000, and in 1925, with 790,000 inhabitants, it would be 59,000,000 galls., the Board believes that in the near future the further development of supply will be necessary.

The report states that no Tremont meters have been purchased since June, 1885; that many have been removed in consequence of stoppage and failure of mechanism, and the company supplying them will not replace faulty meters under a claim on their part that their guarantee did not apply to cases cited. Litigation alone will settle the difficulties between this company and the City.

The report concludes with a Summary of Statistics, for the year 1886, in accordance with the recommendation of the New England Water-Works Association—a most commendable departure that can not be too soon universally adopted in similar reports.

PERSONAL.

MESSRS. D. H. NEALE, B. B. ADAMS, JR., and C. M. S. MCCLELLAN are announced as editors of the *Railroad Gazette*, jointly with Mr. WM. HOWARD WHITE. Mr. D. H. NEALE has been connected with the paper for the past three years as associate editor. The other three editors are new to its staff.

MESSRS. WINSTON BROS., the well known contractors, of Minneapolis, Minn., write us to correct the statement made Jan. 8, in this column, that J. S. WINSTON, who died recently at Richmond, Va., was *not* a member of their firm. J. S. WINSTON, deceasd was in early days a contractor on the Northern Pacific R. R. and more recently on the Canadian Pacific R. R.

THE BIRMINGHAM BRIDGE CO. of Birmingham, Ala., desire us to mention the fact that they have no connection with the "Birmingham Iron Bridge and Forge Co.," of which H. G. WELTY, formerly of Cleve-

land, O., is stated to be the projector in an article in the *Birmingham Age* of Jan. 23.

W. H. STEVENSON, Superintendent of the New York division of the New York, New Haven & Hartford R. R. has resigned; the resignation to take effect March 1.

A. G. WAKEFIELD has been elected President of the Bangor & Piscataquis R. R., in place of the late WILLIAM B. HAYFORD.

CAPT. ADOLPHUS W. GREELY, U. S. A., of the Fifth Cavalry, has been nominated as Chief Signal Officer, with the rank of Brigadier General.

COL. H. R. VANPLANK, in charge of the engineering corps of the Missouri Pacific R. R., has recently inspected a route for a line from Shreveport, La., to Hope, Ark., for a connection with the St. Louis & Iron Mountain R. R.

COL. A. M. TUCKER, Superintendent of the Western Division of the N. Y., P. & O. R. R has been appointed Superintendent of the Susquehanna division of the N. Y., L. E. & W. R. R., to succeed Mr. BLACKHAM, resigned. He will be succeeded by Mr. BARTLETT.

Mr. JOHN W. CLOUD, for a long time Engineer of Tests of the Pennsylvania Railroad, and recently appointed Mechanical Engineer, has just been appointed Superintendent of Motive Power (not General Manager, as a city railroad paper has it) of the New York, Lake Erie & Western Railroad, vice R. H. SOULE, promoted.

Mr. R. H. SOULE has been promoted from the position of Superintendent of Motive Power of the New York, Lake Erie & Western Railroad to the new office of General Manager. Mr. SOULE was for a long time signal engineer of the Pennsylvania Railroad, with which line, and its associated lines, he was for many years connected.

L. E. COOLEY, C. E., Assistant Engineer of the Chicago Drainage and Water Commission, delivered a lecture, on Feb. 8, before the Chicago Academy of Sciences on "The Possible Improvement of Our Drainage System." He outlined existing conditions and then noted the possibilities of improvement and their ultimate effect.

The officers of the Engineers' Society of Western Pennsylvania, for 1887, are as follows: *President*, ALEXANDER DEMPSTER, Pittsburg; *Vice Presidents*, JOHN A. BRASHER, Allegheny, Pa. and MAX J. BECKER Columbus, O.; *Secretary*, S. M. WICKERSHAM, Pittsburg; *Treasurer*, A. E. FROST, Pittsburg. The regular meetings of the Society are held on the Third Tuesday of each month at 77 Fourth Ave., Pittsburg.

The Hon. CLARENCE PULLEN will deliver his lecture on "New-Mexico: Its Geography, Scenes, and Peoples" before the American Geographical Society at its meeting in Chickering Hall next Monday evening. Mr. PULLEN's lecture, which will be illustrated with stereopticon views, has been received with great favor in New-England, where it has been delivered in several of the larger cities. The lecturer is known to our readers as a Civil Engineer, and is one of the authors of PULLEN & CHANDLIE's Earthwork Tables.

WM. H. DILWORTH, a one-time Civil Engineer, died at his residence in Hoboken, N. J., last week. Mr. DILWORTH came of an old Delaware family and was born about 1832; he graduated from the Delaware College in 1852, and at once entered the engineering service of the Delaware Railroad,. In 1857 he was Chief Engineer of the Delaware & Chesapeake Railroad, and made the preliminary surveys for the Wilmington & Northern and the Baltimore & Potomac railroads. He abandoned his profession during the Civil war to enter into a business partnership with his uncle in New York, and in 1861, he became a resident of Hoboken. Three sons are being educated as civil engineers.

WILLIAM WILLARD WILSON, whose death was noted in last issue, was born in New York City in April 1841, his father being a well-known physician of that city. Removing with his family to Havana in 1857, Mr. WILSON was educated as a civil engineer, and practiced his profession in Cuba and Mexico for some years. About 1867, he removed to New Haven, Conn., and was engaged on the New Haven. & Derby R. R. with Col. M. O. Davidson; and soon after coming to Westchester Co. he was occupied in laying out boulevards in the vicinity of Yonkers. In 1870, Mr. WILSON took up his residence in Yonkers, and was first prominently occupied in the construction of the Yonkers water supply, being appointed on Mar. 14, 1874, by the Water Board as its engineer, and his plans were carried out in its construction. In 1876 he was appointed Superintendent of the water-works, and on Feb. 12, 1877, he was made City Surveyor, remaining in that position until his death. As before mentioned Mr. WILSON was a Member of the American Society of Civil Engineers; he died unmarried.

American Society of Civil Engineers.

A regular meeting of the Society was held at its House on Feb. 16, President WM. E. WORTHEN presiding. The death since last meeting of Mr. W. W. WILSON, Member of the Society, was announced and the usual resolution passed for the naming of a committee and the preparation of a memoir.

The paper of the evening was on *Calculation of the mean Horse Power of a variable Stream and the cost of replacing the power lost by a partial division of the Flow*, read by the author, Mr. WM. H. GRANT. This paper had its origin in an investigation into the partial diversion of the flow of the Bronx river for use as a water supply for the City of New York, and was intended to fix the relative damages due to former owners by reason of this diversion, and the cost of actually replacing the lost water power by steam. The author illustrated his views upon the subject by diagrams and tables, and the paper brought out considerable discussion from the President and Messrs. EMERY, DAVIS and NORTH. The remarks made were guarded owing to the fact that the legal controversy over this very case was not yet decided in the courts and it was deemed unwise for the Society to fully handle a subject in which some of its members were interested professionally on either side of the question.

The Secretary exhibited, for Mr. THORNE, of Pensacola, some very well matured specimens of the *teredo navalis*, from that point.

Michigan Engineering Society.

This society held its eighth annual convention at Grand Rapids, Mich., commencing Jan. 25: Vice Prest. GEO. E. STEELE presided with M. E. COOLEY, of Ann Arbor, as Secretary. Those present: were GEO. E. STEELE, Traverse City; M. F. COOLEY, professor of Mechanical Engineering in the University of Ann Arbor; PROF. C. R. BELLOWS, of the State Normal School, Ypsilanti: M. H BAILEY, Diamondale; J. H. LEAVENWORTH, Saginaw City; JOHN J. WATKINS, Lapeer; A. J. TEED, Cadillac; GEO. A. MARE, Hillsdale; J. C. BRADT, Cass county; L. HEMMINGWAY, Benton Harbor; GEO W. DOANE, Pine River; G. A. CHRIST, Assistant engineer G. R. & I., city; F. F. ROGERS, Marlett, G. STEWART JOHNSON, Chief engineer G. R. & I., city; H. A. COLLAR, City Surveyor, city; G. M. AMES Assistant City Surveyor, city; WM. F. GURLEY, Troy, N. Y.; JOHN A. MITCHELL, Government engineer; Ludington; E. TREADWELL, Chief engineer F. & P. M., East Saginaw JOHN J. GRANVILLE, East Saginaw; R. W. ROBERTS, East Saginaw; W. B. STIMSON, Road master G. R. & I., city. CHARLES E. GREENE, Professor Civil Engineering, University, Ann Arbor,; WM. APPLETON, Lansing; W. R. COATS, Kalamazoo.

Aside from the address of welcome by the representative of the mayor, the annual address by MR. GEO. E. STEELE and the routine reports, the following papers were read during the session:—"Gas Engines", by Prof. M. E. COOLEY; "A Land case before our Supreme Court" by F. HODGMAN; "Standard Bridges", by E. TREADWELL; "The Engineer; His Position and Duties", by J. J. WATKENS. "River Crossings for Water Mains", by W. R. COATS. The officers elected for the current year were *President*, GEO. E. STEELE; *Vice President*, E. F. GUILD; *Secretary* and *Treasurer*, F. HODGMAN, of Climax, and *Asst. Secretary*, GEO. E, PIERSON, of Kalamazoo.

The Engineers' Club of Kansas City.

This club was formally organized at Kansas City on Feb. 5, and the following officers were elected:—President, WM. B. KNIGHT; Vice President, J. A. L. WADDELL; Directors, OCTAVE CHANUTE and CLIFT WISE; Secretary and Treasurer, KENNETH ALLEN. The Society has 33 members at present.

CORRESPONDENCE.

The Illinois Central and the Dubuque Bridge.

78, *Michigan Ave.*
CHICAGO, ILL., Feb. 12, 1887.

EDITORS ENGINEERING NEWS:

I see in an editorial note which appeared in your last issue, that you refer to the bridge across the Mississippi River at Dubuque, and state that that bridge had been built by the Bridge Co. except one short span which was built and owned by the Illinois Central Co.

This gives an incorrect impression of the true state of the case. This bridge across the Mississippi was built to the Illinois shore line of the river in 1867. When it was built there was on this shore a sloping bluff. The Illinois Central excavated this bluff back from the shore line for 200 ft. for its tracks and then, there not being space in this 200 ft. to get the necessary curve to reach the bridge, it built through the bluff a very costly and expensive tunnel and reached the bridge from this tunnel by an embankment. In this embankment there was an opening left, for the passage of trains underneath, and this opening was covered with a jack-knife draw, which has to be open whenever trains pass underneath, there being not otherwise sufficient elevation.

This being the state of the case, the Illinois Central very naturally has objected to the use of the tunnel and approach, which they had built at great cost, by other companies, except upon proper compensation. It is open to the other railroad companies to approach this bridge in the same manner as the Illinois Central have done, but the proceedings at law, which evidently have led to your article, are, it is generally understood, instituted to get the benefit of what the Illinois Central has done without making compensation therefore.

I desire to present the true facts to you, as I am sure you are interested in having them.

Yours truly, JOHN DUNN.

[The right to compensation, and full compensation, is undoubted. The reports which have been repeatedly and very generally published were that compensation was tendered and refused.—ED. ENG. NEWS.]

CLEVELAND, O., Feb. 2, 1887.

EDITORS ENGINEERING NEWS:

While I, like every other member of the profession, must rejoice to see the American Society of Civil Engineers growing at the rate set forth in the interesting tables, given in the ENGINEERING NEWS of 29 ult., I fail to see how it can be expected that your expectation of having "all members of the profession, young as well as old, enrolled in its membership and sharing its benefits," should be realized. In what respect, for instance, should I be benefitted? I am a young man, but three years out of college. I could only come in, I suppose, as a "junior," and for that and for the privilege of receiving the publications, I must pay $20 to enter, and $15 a year. I see all their publications now, and if I did not, should see the substance of the most important papers in the ENGINEERING NEWS and other papers, while it has cost me only an initiation fee of $5 and a yearly due of $6, to join the Civil Engineers' Club of Cleveland, by which I get the advantage of seeing *both* the American Society's and the other Society's publications, and of taking part in the only meetings which it would be possible for me to attend if I belonged to a dozen societies. When I am old enough to come in as a Member of the American Society it may be different, but why should I, or any young man situated as I am, pay $15 a year for the empty honor of being a junior member of the American Society?

Y. C. E.

[Our correspondent has not informed himself correctly as to the dues of the American Society, which are $10 for junior members, and not $15. What further we have to say is said elsewhere.—ED. ENG. NEWS.]

The Latimer Re-railing Bridge.

POTTSVILLE, PA., Feb. 15, 1887.

EDITORS ENGINEERING NEWS:

In the engraving of Latimer's bridge guard, given in your issue of Feb. 12. I notice that the guard-rails are set up close to the main rails. Do you consider this the best plan? My reason for asking this question is, that I have seen guard-rails placed as far as 8 in. from main rail, and am therefore in doubt as which distance would prove of the most safety.

Yours truly,
EMILE LOW.

[In connection with the Latimer re-railing device it is unquestionably the best plan. That device will replace a wheel off the rail with almost absolute certainty, and when the wheels are once on, the closer the guard-rail comes to the wheel, so that it does not touch it, the better. The guard-rails on the New York elevated tracks are set very close, and have many times rendered the most impor-

tant service. We should judge setting the guard-rails away from the main rail was bad practice under any circumstances. ED. ENG. NEWS.]

The Elevated Road in Kansas City.

BOSTON, Mass., Feb. 12, 1887.

EDITORS ENGINEERING NEWS:—

A statement occurs in your issue of Feb. 5, to the effect that the proposed Chicago elevated railroad, if built, will be the only one outside of New York and Brooklyn. It is but due to the enterprise of Kansas City to say that an elevated road was built in that city last summer. Reference is made to it, I believe, in one of your November numbers.

Yours truly,
GEO. GOODRICH.

[We owe Kansas City an apology, about 3½ miles long, single track, in 50 ft. spans; as per our issue of Oct. 30, 1886.—ED. ENG. NEWS.]

The Striking of Clocks.

BOSTON, Mass., Feb. 4, 1887.

EDITORS ENGINEERING NEWS:

Suppose that the striking of clocks were everywhere arranged, as suggested in your able editorial note of February 5th, somewhat after the analogy of fire-bells and other signals, with strokes grouped on a ten-fold basis. Ten o'clock and twenty o'clock would thereby have a certain prominence, and decimal, arithmetical notation of the hours would be implicitly adopted; noon being called to mind as two-and-ten hours after midnight, rather than one dozen hours, and the end of the day obviously striking the listener's mind as four-and-twenty o'clock and not by any possibility as eight-bells of ship's time nor as the sixth hour of the old Italian reckoning (which is said to have begun at sunset and counted twenty-four hours, but to have had clocks strike only to six and then begin at one again).

With this decimal striking of hours established, a man who cared anything for *system* would naturally ask, "Why in the world should the day end with four-and-twenty hours rather than with some number more appropriate to decimal reckoning?" A day of twenty-four hours would then look to him somewhat as does the guinea of 21 shillings in British money. The sovereign of 20 shillings is obviously in a preferable ratio; the guinea ceased to be coined long ago, though the name of guinea is still used freely for 21 shillings in speaking of fees, etc. The coinage, weights and measures of nearly all civilized nations have been decimalized within the last hundred years, and it would not be strange if time reckoning should after a while be decimalized likewise; but for many years to come it is sure that the day must continue to be divided into twenty-four hours, and, therefore, for many years there will be no special disadvantage in having clocks strike in some way appropriate to the number twenty-four irrespective of decimal notation. F. B.

[When our correspondent launches out into such an immense reform as a change to a day of twenty hours instead of twenty-four, he goes too fast and too far for us to follow him, but we give him his say. A reform more utterly chimerical, or offering fewer advantages for the trouble, it strikes us, would be difficult to imagine, and such suggestions are liable to impede the progress of the really desirable and reasonable change to a twenty four o'clock notation. We presume our correspondent would adopt a 400° circle with his twenty-hour day, but both of these changes strike us as likely to be rather crab-like reform.—ED. ENG. NEWS].

DRY POWDER FOR STAINING.—THE WALPOLE DYE & CHEMICAL WORKS, of Boston, Mass., are introducing a novelty in the form of a dry powder for staining wood, coloring varnish, japans, etc. The advantages claimed are—saving in freight between 15 lbs. and 300 lbs.; no loss from leakage or freezing; no evaporation; no expensive packing, and a great saving in first cost, the deepest stains being produced for 50 cents per gallon. The color is soluble in boiling water or alcohol and is transparent.

PUBLICATIONS RECEIVED.

The Principles and Practice of Canal and River Engineering. By DAVID STEVENSON, F. R. S. E.; M. I. C. E. author of a "Sketch of Civil Engineering in North America," "Marine Surveying," "Reclamation and Protection of Agricultural Land," "Life of Robert Stevenson" etc. Third Edition, New York, Scribner & Welford, pp. 486; large octavo, 18 Plates.

This book was originally published in 1858. It may fairly be called one of the standards on its subjects. Much new matter was added to the second edition of 1872.

Tables for Calculating the Cubic Contents of Excavation and Embankments, by an Improved Method of Diagonals and Side Triangles. By JOHN R. HUDSON, C. E. second edition. New York, John Wiley & Sons, pp. 90, 29 tables.

A long table of areas with cubic yards for 50 feet lengths, and a form of cross-section book, with some other matter have been added since the first edition, which we have already noticed.

Red River Valley Drainage in Minnesota. Commissioners Report, Minneapolis, Minn. 1887. Pamph. pp 31, 5 large Plates. Contains some valuable technical matter. The project is to spend $746.12 8 in reclaiming 808,600 acres or 92 cts. per acre. The report is well prepared.

Life and Work of the Seventh Earl of Shaftesbury, K. G. By EDWIN HODDER. Cassell & Co., London and New York, 3 Vols. 550 pp. each.

The Common Chord. A story of the North Ward. By HENRY R. ELLIOT, Cassell & Co. London & New York, 294 pp. $1.00.

Hodgman's Field Book for Land Surveyors. A note book, leather-bound with flap, 4x6½ in. in size; it is ruled in small cross-sections (about 6 to the inch, adapted to all classes of notes, and contains 15 pages of tables of nat. sines, tangents and sectants, departures traverse tables and azimuths of Polaris. It is endorsed by the Mich. Eng. Society, and is for sale at 75 cts. each ($8 per doz.) by F. Hodgman, Climax, Mich.

The Source of the Mississippi. Reprinted from *Science.* This is a summary of the evidence against the claims of Captain Glazier, and contains the letter of Messrs. Ivison, Blakeman, Taylor & Co., and the report of Hopewell Clarke, with maps.

Biennial Report of the Board of *Capital Managers* of the State of *Colorado*, 1886. Gives general instructions to contractors; propcsals presented; detail floor plans, with dimensions of rooms, and the report of the Denver Society of Civil Engineers on the building stones presented for test.

Report of the Regent's Boundary Commission upon the New York and Pennsylvania Boundary, with the Final Report of Major H. W. Clarke, C. E., Surveyor for the Commission. Albany, N. Y.: State Printers, 1886, with numerous maps and sketches.

This is a most voluminous and careful report upon the determination, restoration and marking of the boundary line between the States named. It enters very fully into the history of the boundary, from the original grant to Wm. Penn to the first determination of the line in 1774, and the after surveys to date. Major Clarke in his final report, which includes all but 30 of the 456 pages of the document, makes very interesting reading for a usually dry subject; and the facsimiles of old maps, sketches and completed plans of new surveys and the historical and technical information given render the report a most valuable document.

TECHNICAL NOTES.

DENVER, Colorado, at 5,175 ft. above sea-level and Annapolis, Md., at 4 ft., represent the highest and the lowest State capitals in the United States, as far as elevation above the sea is concerned.

DR. MORITZ FLEISCHER, in a recent number of *Biedermann's Centralblatt*, again calls attention to the value of basic slag as a manure. He says the phosphoric acid of basic cinder is more easily assimilated by plants than this same acid in ground mineral phosphates, and it is easy soluble. The cinder should be ground as fine as possible; it is more quickly effective than ground coprolites, or even ground bones, and is to be preferred for sandy or clayey soils poor in lime, in wet meadows and clover fields.

DR. FR. HOFFMANN suggests finely powdered white talc as a cheaper, quicker and better filtering medium than other material used. It should be finely powdered, well washed in hot water slightly acidulated with hydrochloric acid and again washed with hot water to remove all traces of the acid. This filter is to be used by mixing about ½ oz. of the talcum with 1 pt. of hot water in a bottle; shake well and then pour on the filtering paper so as to evenly distribute the mixture upon the sides of the filter.

EXPERIMENTS are being made on the North Metropolitan Railway, of London, with one of Mr. ELIESON'S electric locomotives. This machine has outwardly the appearance of a short tramcar. It carries 80 Elieson cells, capable of storing power sufficient to drive the engine at full speed for four hours. There are eleven plates in each cell, each plate being a grid of lead, 9x9 in. and ¼ in. thick, perforated with 169 square holes, and in each hole is a small coil of lead-foil and asbestos paper. The total area of the lead strips is 1,800 sq. in., and the cells are charged at the depot by a 25 h. p. engine driving two Phœnix dynamos. The engine weighs 6½ tons, and the tramcar empty 2½ tons, and when carrying 46 passengers, 5 tons. At an experimental trip the engine averaged 6 miles per hour, with a speed at time of 8 miles, and it was readily stopped and started on ascents of 1 in 30.

LIEUT. ZALINSKI'S new dynamite cruiser, now building by CRAMP & SONS, of Philadelphia, promises to be a most formidable engine of destruction. It is to have a speed of 20 knots per hour, project 400 lbs. of dynamite a distance of from one to two miles, and carry 30 of these shells, or 12,000 lbs. of the explosive. Well may the London *Times* call this craft "the most infernal triumph of American ingenuity." The vessel will be 250 ft. long; 26 ft. beam; draw 8 ft. of water and have a displacement of about 800 tons. The engines will be triple expansion, guaranteed to be 3,200 h. p., and are expected to develop 4,500 h. p. The guns are simply three long steel tubes, 12½-in. diameter, lined with brass and ranged alongside of each other on a line with the keel. The projectile is a copper cylinder, capped with solid iron, filled with 400 lbs. of nitro-gelatine and provided with a long wooden shaft to secure accuracy of flight; the charge may be exploded by contact or by a minute electric battery, enlivened by immersion in water to any fixed depth. The propelling force is air compressed to 1,000 lbs. per sq. in. She can carry coal enough for 5,000 miles at 12 knots, or 700 miles at full speed, and can turn in twice her length, by means of twin screws, in from two to three minutes.

AN era of tall construction seems to have broken out generally among the nations. America lately finished the Washington Monument, topping it out at a height of 555 ft.; and the tower of the Public Buildings in Philadelphia will be 537 ft. high when finished. Next we have M. EIFFEL proposing to erect a 1,000-ft. tower in Paris; and now we are to have another tower 420 ft. high, in London, to commemorate Her Majesty's Jubilee Year.

IT has been determined by recent observations that the average yearly recession of the whole contour of the Horseshoe Fall since 1842 has been 2.4 ft., but at the acute angles where the bulk of the water passes the recession since 1842 has been 300 ft., or 7 ft. per year, the rate increasing in recent years. We hope this has been more correctly determined than the newspaper reports of the great mass of "223,000 cu. yds." which recently fell, "60 ft. wide by over 100 long by 170 deep," which figures up only 37,777 cu. yds., or 1,020,000 cu. ft., even allowing the mass to have been "parallelopipidonical."

THE *Providence Journal* gives details of one of the heaviest fast passenger engines yet built, having 72,000 lbs. on four drivers, over 7 ft. between centers, and weighing 96,000 lbs. in all. The engine has been specially designed to haul the fast shore line express of 8 cars 62½ miles in 62½ minutes. Its grate is more than double the usual size, or 38 sq. ft. and its heating surface also large, while it carries the very high boiler pressure of 180 lbs. What useful purpose was subserved in placing such a heavy load on the drivers for an engine to run at such high speed and with few stops does not appear, and we cannot but doubt if it ever will.

This engine does not quite come up to the maximum limit in the most recent bridge specifications, but it comes pretty close to it; so near that it would be interesting to see a *correct* computation of the difference in strains which result from the passage of such a load at 75 miles an hour and at 30 or 40 miles an hour. Could a correct comparison of the actual strains be made with the computed strains of the strain-sheet, it is a safe surmise that the contrast would be striking in some of the members.

CONSTRUCTION NEWS.

Water.

The American Chemical Society, of New York, discussed the analysis and the purification of water at its conversazione on last Friday evening.

Gas Pipe.—The HARPER & REYNOLDS Co. has received the contract for pipe for the Consumers Gas Light, Heat & Power Co., of Los Angeles, Cal.

Centerville, Ia.—The city is ready to receive bids for the sinking of an artesian well. Plans and specifications can be had by addressing the city clerk.

Water Pipe.—The Board of Water Commissioners of Altoona, Pa., is receiving prices for water pipe. The secretary will advertise for proposals for hydrants, gates and 6-inch pipe.

The Arlington Land & Water Power Co. has been incorporated in Kansas. The directors are F. R. CHRISMAN, A. J. LUSK, FRANK COLLADY and others, of Hutchinson, Kan., where the office will be located. Capital stock, $30,000.

New Water-Works.—The attention of contractors is directed to the advertisement of the city of Natchez, Miss., which is inviting proposals for erecting water-works.

Patchogue, L. I.—The Town Board of Brookhaven, L. I., has granted the franchise to supply the village of Patchogue with water, to JOHN LOCKWOOD & Co., of New York City. Two miles of mains are to be laid. The company must supply water for all public buildings, for sprinkling the streets and for two public fountains.

The Miami Natural Gas Co. has been incorporated at Columbus, O., to operate a pipe line from the Lima field to Dayton, Cincinnati and other cities. The capital stock is $2,000,000 and the offices are at Dayton, O. The incorporators are J. J. VANDERGRIFT, of Pittsburg, Pa.; L. H. SMITH, of New York; JOHN BROWN, of Toledo, O., and others.

Newark, N. J.—The city controller invites proposals for $160,000 city of Newark 4 per cent. ten year sewer bonds, for which the credit and property of the city is pledged.

Bursting of a Reservoir.—The south end of the large reservoir recently built by Hon. G. W. BROWN, two miles east of Galesburg, Ill., gave way February 12; and there was fear that the pond of the C. B. & Q. R. R. would also give way; a large force of men was kept on hand. The damage done to the property of the Galesburg Pressed Brick & Tile Co. is estimated at about $1,500.

Shelbyville, Ill.—COL. S. H. LOCKETT, chief engineer of the contracting firm of Messrs. COMEGYS & LEWIS, of New York City, writes us that the accident to the stand-pipe, mentioned last week, was by no means so serious as reported. The accident was simply a break in the overflow or waste pipe, which caused a temporary disuse of the stand-pipe amounting to a day or two; the break was at once repaired and the stand-pipe is now in use. No damage was caused the stand-pipe itself.

Electric Lighting.—Glen Falls, N. Y. The question of lighting the town by electricity will be voted upon shortly

Worcester, Mass. It is proposed to appropriate $50,000 for street lighting during the current year.

Norwalk, Conn. An electric light system is to be experimented with soon.

Sandy Hill, N. Y. A vote will be taken shortly on the issuing of bonds for lighting the town by electricity.

Willimantic, Conn. An electric street lighting system is contemplated.

Cornwall, Ont.—The town of Cornwall, Ontario, Canada, is building water-works. There are two Worthington pumping engines, 12 x 12 in by 8 ins., which pump into the mains, a stand-pipe being used to equalise the pressure; this stand-pipe is 124 ft. high and 20 ft. diameter at the bottom. It is built of ⅜-in. to ¼-in. iron and the courses are set one inside the other; its capacity is 400,000 gallons. The pressure is 70 pounds. There are to be 64 hydrants and 7 miles of pipe, 4, 6, 8 and 12 ins. diameter; on the pumping main between the distributing main and the stand-pipe is placed an electric valve. The works are to cost $100,000.

Removing Wrecks.—The following proposals have been received by Lieut. Col. WM. P. CRAIGHILL, U.S. Engineer Office, Baltimore, Md., for removing wrecks in the Patapsco river: American Dredging Co., Philadelphia, Pa., $395, (to destroy the wrecks and remove the broken parts by dredging). Baltimore Wrecking Co., Baltimore, Md., $800, (to raise the wrecks and place them on the beach).

Dredge.—Messrs. CARKIN, STICKNEY & CRAM, of East Saginaw, Mich., have let the contract for a large steam dredge, to be ready for work in the spring. The crane arms will be 40 feet long. The main engine will have cylinders 14 by 20 inches and the swinging engine, 9 by 16 inches. It will be used where there is rock bottom and for heavy works.

Levee Work.—The State Board of Engineers, at New Orleans, La., has received the following bids; Reserve levee; J. J. FRAWLEY, 11.75 cents per cubic yard; P. BURNS, 11.8; W. DOWLING, 13.5; T. HARNAN, 14 cents.

Staten Point levee; W. ROBSON, 11 cents; OGDEN & JONES, 13.95; R. M. WHITE, 15¾.

Estimated Cost of Quaker Bridge Dam, Reservoir and Appurtenances:—

Quaker Bridge Dam	$3,000,000
Gate-house and sub-structure	255 000
Gate-house and superstructure	100.000
Overflow sub-dams, etc	250,000
Temporary dams and flumes	50,000
Contingencies, 10 per cent	380,000
Muscoot Dam	300,000
Roads and highways	410,000
Bridges A. and P. (see map)	415,000
Railroads, etc.	196,000
Clearing basin	200,000
	$5,541.000
4,000 acres of land	1,200,000
	$5,741,000

More Submerged Water Pipe—Mr. G. NORMAN WEAVER Eng. of the Green Bay Wis., Water-Works Co., has laid a 12-in. cast-iron pipe across the Fox river at that place. This river is 1,200 ft. wide and in one place nearly 31 ft. deep for 100 ft. The bottom is irregular in level. The work was done from the ice, the pipe for the deep portion being first put together with lead joints and the pipe sections doweled together; the jointing was made at the requisite angle and the pipe lowered by rope and windlass so as to keep the two ends above water, the work was completed in about two weeks in all. The work was done by the New England Construction Co.

A Comprehensive Jersey Water Scheme—A bill is now before the New Jersey Legislature which provides that whenever the mayor, or a majority of the board controlling the finances, of any city of over 10,000 inhabitants shall state to the Governor in writing that the city desires to construct water-works, the Governor shall appoint one or more trustees with corporate powers to act as a "Public Water Trust Co." These companies have power to divert streams and build water-works; and the cities represented shall issue 5 per cent. forty-year bonds separately, but not exceeding $3,000,000 in the aggregate. Each city represented must pay in proportion to its population for the expense of maintaining works. And in case a city refuses to issue bonds, the company is empowered to issue bonds and to build the works in the same manner as if the city had authorized the same; and the money is to be raised by taxation or by mandamus of the Supreme Court commanding the city to pay.

Laying Submerged Water Pipe.—Mr. W. R. COATS, of Kalamazoo, Mich., lately read a paper before the Michigan Society of Civil Engineers describing the laying of a water main across the Grand River at Grand Rapids, Mich., in Aug. and Sept., 1886. The main was 16-in. in diameter, with lead joints and imbedded in the lime-stone bottom of the river. Mr. COATS tendered to do the work for $5.50 per lin. ft. for the river section and 65 cts. for the part on shore, including in this price the removal of an old 12-in. wrought-iron main. The city furnished the new pipe. The work was accomplished by first clearing the bottom of sand and then building a false-works of 70 bents of trestle-work, this bridge being 8 ft. high and the water from 4 to 6 ft. deep. The rock was blasted by Hercules powder loaded in 30-in. holes, drilled about 2 ft. apart (half-pound charges): The entire length of this trench was about 800 ft. The pipe was put together on the false-works with hemp gasket and lead, and then lowered by chain slings at intervals of 24 ft. 4 each sling being attached to 1¼-in. screw-rods, 9 ft. long, passing through nuts supported on special cross-caps. The pipe was lowered in 2½ hours to its place.

Detroit, Mich.—The Water Board has submitted its report for the past year. There have been 39 miles of water mains laid, half of which was in the new ward: 2,100 service connections have been made, and a stand-pipe has been erected, making it possible to discontinue the use of the reservoir. The third engine at the pumping station has been completed, giving an aggregate daily pumping capacity of 80,000,000; during the year the total amount pumped exceeded the total for 1885 by 606,000,000 gallons. The efforts of the Board to prevent the excessive waste of water have not been successful. By the will of the late CHAUNCEY HURLBUT the Board has come into the possession of his valuable library and a large estate, the net proceeds of which are to be used solely in the maintenance of the library and in adorning and improving the grounds of the new pumping works. The engines pumped an aggregate of 10,576,571,254 gallons in a total of 9,258 hours, at a total cost of $20,387.24. Iron pipe laid, 39 miles; relaid, 1,230 feet; wood, 717 feet. Over four miles of wooden logs and about 4¼ miles of iron pipe have been discontinued, making the net increase of pipeage about 33½ miles; this amount added to the measured lines of pipes and logs connected with the works would make the pipeage of the city about 360 miles, of which 236¼ miles are iron pipe and 63¾ miles wooden logs. During the past season 433 stop gates have been set and reset, and there are now connected with the water mains 1,227 fire hydrants and 274 reservoirs; 185 hydrants and 40 reservoirs were added during the year.

The report contains the following comparative table:

	Gallons pumped.	Rates collected.	Cost of maintenance.
Buffalo	12,169,882,676	$477,209.57	$95,031.04
Detroit	10,576,571,254	314,962.81	71,176.44
Cleveland	7,128,673,365	308,581.76	85,616.76
Milwaukee	6,525,629,311	250,248.37	89,104.91

Railroads, Bridges and Canals.

Railroad Notes.—The Bush Interlocking Bolt Co. Philadelphia, have received a contract from the New Jersey Junction R. R. Co. to equip all the bridges and trestle work on their road with the Bush Interlocking Bolts.

Railroad Commission.—The proposition to establish a State Railroad Commission for the regulation of freights and fares has been voted down in the North Carolina house of representatives.

The Miller Brake.—The rights of EZRA MILLER have been sustained in the U. S. Circuit Court, at New York, in his suit against the Pennsylvania R. R. Co. for $300,000 for an infringement on his car brake patent, by a verdict of six cents and costs.

Brooklyn Cable Railroad.—The line of the Brooklyn Cable Co. will be in operation next month; horses will be used from Fulton ferry to Grand avenue until the cable system is extended. The cars have been ordered from the JOHN STEPHENSON Co. Mr. MILLER A. SMITH is the company's engineer.

Poughkeepsie Bridge Connections.—The Poughkeepsie Connecting R. R. Co., and the Hudson Connecting R. R. Co., have been incorporated by W. VAN BENTHUYSEN and DAVID PATTERSON, of New York, and others; with a capital stock of $1,000,000 each. The first is to run from the bridge to Moore's Station on the New burg, Dutchess & Connecticut R. R., 10 miles; and the latter from the bridge to a junction with the Wallkill Valley R. R. at Pine Bush, Orange county, 20 miles.

Baltimore & Ohio R. R.—The company is buying property at Philadelphia, on the north side of Filbert street between Broad and Twenty-second streets. The purpose is to parallel the Pennsylvania R. R. Co's elevated viaduct and to build a large depot on the northwest corner of Broad and Filbert streets. The maps and plans for this work have been prepared, and the total cost is estimated at over $2,000,000. The company does not expect to have any serious difficulty in obtaining the necessary permission from the council.

Bridge Companies.—At Fort Smith, Ark., the Fort Smith Bridge Co. has been organized by C. F. BOCQUIN, W. N. AYERS and others, to build a bridge across the Arkansas river.——At Clinton, Ia., a company has been organized to build a bridge over the Mississippi river; capital stock $250,000; for particulars address W. I. HAYES, House of Representatives, Washington, D. C.——At Jefferson City, Mo., a company has been organized by E. B. EWING, JACKSON L. SMITH, and others, to build a bridge across the Missouri river to Cedar City.

Galveston Harbor.—A resolution has been adopted at a meeting of citizens of Galveston, Tex., looking to an appeal to the Legislature to amend the general State laws so as to permit the city to carry out harbor improvements independent of the present system of government works. Mr. ONDERDONK has made a proposition to furnish a channel over the bar, 20 ft. deep and 250 ft. wide, for $500,000 and $100,000 for one year's maintenance: the work to be completed in six months; payment to be contingent on securing the required depth of water.

Street Railroads.—At Albany, N. Y., Mr. TRAPHAGEN has introduced a bill for cable railroads in New York and Brooklyn.——At Rome, Ga., a franchise has been granted to the Rome City Street Railroad Co.; where the track covers any monuments an iron bolt is to be driven down as directed by the city engineer.——At Birmingham, Ala., the Birmingham Street Railroad Co. and the Birmingham & Pratt Mines Street Railroad Co. have been consolidated: electricity is proposed to be adopted.——The Boston Consolidated Horse Railroad Co. will build a line to West Medford.——At Raleigh, N. C., the street railroad will be extended.——At Augusta, Ga., the Augusta & Summerfield Street Railroad will be extended.——At Memphis, Tenn., T. J. LATHAM is interested in a street railroad scheme.——At Framingham, Mass., a street railroad company is to be organized.——At St. Paul, Minn., Mr. THOMAS LOWRY states that the cable roads will be put under contract very soon.——At Harrisburg, Pa., a bill has been introduced by Mr. ROBERTSON and Mr. MAGEE to combine all the street railroads in Pittsburg and Allegheny under one management.——At Hastings, Neb., the proposition for a street railroad was carried by a vote of 656 in favor against 207 opposing.

Philadelphia Metropolitan R. R.—The ordinance granting to the Metropolitan R. R. Co. authority to construct an underground railroad has been favorably recommended to the council by the Railroad Committee. Chief Engineer SMEDLEY stated that it was proposed to construct the road at such a depth as not to interfere with the largest sewers but to pass under them, and that many of the difficulties presented could hardly be overcome. The company must file a bond for $10,000 with the City Solicitor, conditioned that work shall be commenced within six months after the acceptance of the ordinance and complete one-seventh of the work within one year and finish the road within seven years: any failure to comply with the conditions of the ordinance to forfeit all rights of the company. Fares to be 5 cents between 5 and 8 o'clock A. M., and 7 o'clock P. M. It is reported that the cars will be run by electricity.

Length of Branch Railroads.—A suit was recently brought against the Baltimore & Ohio R. R. Co. by MATTHEW VOLLMER, a property owner in the "Neck" near Philadelphia, through whose land the Delaware River branch passes. He asked for an injunction to restrain the building of the branch on the ground that as it was over six miles long it could not fairly be called a "branch" of a road which was only three miles long and that its construction was therefore, not authorized by the branching powers conferred upon railroads by the act of 1868. The court decided against him and the case was taken to the Supreme Court, where it was urged that such a construction of the act would enable a railroad ten miles long to build a branch 300 miles long. In deciding against VOLLMER JUDGE PAXSON says: "The act of 1868 fixes no limit to the length of a branch to be constructed under it. That is left to the sound discretion of the company and in a case free from a willful abuse of the power the court will not interfere. We see nothing in this case to indicate an abuse of power by the defendant company."

Railroad Legislation.—*Maine.* On Feb. 23, the Legislature will consider the acts to incorporate the Calais River R. R. Co., to amend the section of the Revised Statutes relating to railroad crossings, to amend the act of 1885 incorporating the Biddeford & Saco R. R. Co., to incorporate a railroad from Skowhegan to Norridgewock, and to construct a railroad from the York terminus of the York Harbor & Beach R. R. to a junction with the Boston & Maine R. R. at Wells.—*Alabama.* The following bill has been introduced: to incorporate the Birmingham, Mobile & Navy Coat Harbor R. R. Co.; the senate bills to incorporate the Mobile & Dauphin Island R. R. Co., and to authorize certain railroads to build extensions and new lines, have been passed.—*Minnesota.* Mr. SNIDER has introduced a bill providing for the heating of railroad cars; the companies to provide a special iron or steel car for each train, to carry all heat and light producing mediums.—*Ohio.* A bill has been introduced to authorize the County Commissioners of Muskingum county to sell the Muskingum Valley R. R., with telegraph lines, etc., for $130,000.—*Missouri.* A bill has been drafted by R. C. KERENS, Vice President of the St. Louis, Arkansas & Texas R. R., to give new lines the right to enter St. Louis over the lines of other companies on payment of a reasonable rental.

New Bridges.—A new bridge, to be built high and strong, will be built at Fort Niobrara, Neb., to connect the post with Valentine and the railroad; the existing bridge is expected to be washed out in the spring.—Bills have been introduced into the Minnesota legislature by Mr. COSTELLO, to authorize appropriations for bridges in Traverse, Lincoln and Big Stone counties.—At St. Paul, Minn., a new bridge is projected across the river at Broadway; EDWARD LANGEVIN and JOSEPH GUION are on the committee.—The bill authorizing the Oregon Railroad & Navigation Co. to bridge the Willamette river at Portland, Ore., has passed the Senate.—At Washington, D. C., a bill has been introduced by Mr. BARBOUR for the erection of a bridge across the Potomac, with a carriage-way of 25 feet, a street car-way of 20 feet and two 8 feet passenger walks; also a draw; $500,000 to be appropriated. Mr. CURTIN has introduced a bill for a Grant memorial bridge across the Potomac; plans prepared by Capt. T. W. SYMONS, engineer, and SMITHMEYER & PELZ, architects; appropriation, $500,000.—At Lachine, Canada, work is progressing on the St. Lawrence bridge; 75 feet of the cantilever has been erected.—The South Florida R. R. Co., at Sanford, Fla., will build a bridge over the Hillsborough river, estimated cost, $20,000.—At Wilmington, N. C., the city will build an iron bridge, 141 feet span, over the railroad, at a cost of $13,000.—The bill authorizing the Supervisors of Harrison county, Miss., to build a bridge across the Barnard bayou has been passed by Congress, and the bills authorizing the Georgia Pacific R. R. Co. and the Talladega & Coosa Valley R. R. Co., to build bridges have been reported favorably by the Senate commerce committee.

The Dayton & Ironton R. R. Co. will build a bridge across the Ohio canal at Chillicothe, O.—Walton, N. Y., will build a new bridge across the Delaware river.—At Chicago, Ill., the Commissioner of Public Works has been directed to send in estimates for viaducts over the railroad tracks at Jefferson street and at the south approach to the Halsted street bridge; also for a single bridge at Canal street; the cost of the single bridge at Blackhawk street is estimated at $79,500.—Gen. W. D. WASHBURNE, of St. Paul, Minn., reports that arrangements have been made for building the Sault Ste. Marie bridge and that Mr. VAN HORNE has been directed to purchase material; it will be of steel and will cost $560,000.—The Kansas and Missouri Bridge Co. will repair the bridge at Fort Leavenworth, Kan.—At Aurora, Ill., a vote will be taken Feb. 21 on the question of erecting a bridge at North Aurora.

New Railroads and Extensions.—Pana & Roodhouse R. R. The right of way has been granted through Pana, Ill., and the road will be built this year; it will ultimately reach Quincy.—Denver, Memphis & Atlantic R. R. The line has been completed and opened between Cedarville and Chetopa, Kan.—Chicago, Kansas & Western R. R. Work is progressing on the branches and the South Bend extension is under contract.—San Antonio & Aransas Pass R. R. The road is located through Eagle Pass, Tex.; it is to be run northward to meet lines that are to be built south from Denver, Col.—Frankfort, Georgetown & Paris R. R. The road will be built this year; two routes are mentioned, one from Paris, Ky., to Mount Sterling and through the eastern mountain counties into Virginia near Pound Gap, the other by way of Flat Rock, Sharpsburg and Owingsville and through West Liberty into Virginia; the latter route is the most favorable. HON. W. P. D. BUSH is President. Arkansas Midland R. R. The line will be widened to standard gauge; J. B. JOHNSON, Superintendent, Helena, Ark.—Georgia Midland R. R. Track laying has reached beyond Shiloh, 80 miles are graded; the tunnel near Shiloh is completed.—Ohio Valley R. R. The line will be built from Henderson to Princeton, Ky., if the latter place subscribes $20,000.

Hot Springs R. R. The line will be extended into the Bear Mountain mining region if the Moffett smelting works at Crystal Springs prove the richness of the ore; JOSEPH REYNOLDS President, Hot Springs, Ark.—Chicago, Rock Island & Pacific R. R. The road will be extended through southern Kansas to New Mexico; the authorized line through the Indian Territory will start from Caldwell, Kan., and run by Fort Reno; the southwestern branch will leave No Man's Land and make for Cisco, Tex.—Chicago, Milwaukee & St. Paul R. R. The company has been petitioned to run a branch from Browntown, Wis., to Blanchardville.—Illinois Central R. R. A branch is to be built from Canton to Aberdeen, Miss., a distance of 60 miles.—International R. R. Bangor, Me., is strongly opposed to the projected amendment for an independent line from Greenville to Brownville, 40 miles.—Cincinnati, Hamilton & Dayton R. R. A line is to be built between Liberty, Ind., and Dayton, O.; 40 miles.—Tombigbee R. R. At Columbus, Miss., $45,000 have been subscribed and work will be commenced soon. Col. I. O. BANKS is interested.

A railroad is projected from Holyoke, Mass., to a junction with the N. Y. & N. E. R. R. at Springfield; the line has been surveyed. The Syms & Dudley Chemical Co. has contributed largely for the stock.—Grafton Center R. R. The road will be widened to standard gauge and extended to Uptown and Millford, Mass. Mr. KNOWLTON, of Uptown, and Mr. DRAPER, of Hopedale, are interested.—Mount Pleasant & Sullivan's Island R. R. Work on this line from Charleston, S. C., will be recommenced soon.—Southern Maryland R. R. The line between Mechanicsville and California, Md., will be completed this season. A. STILES, Chief Engineer.—A narrow gauge line is to be built from Aqueduct station, on the Pennsylvania R. R., to New Bloomfield, Pa. Capt. FRANK MORTIMER, of New Bloomfield, is interested.—A railroad is proposed from Westboro, on the Boston & Albany R. R. to Northboro, on the Old Colony R. R.; three miles; the Westboro Business Men's Association favors the line.

Proposals Open.

Water Works Supply.—*Pipe*; cast-iron, 4, 6, 8, 10, 12, and 16-inch; *Special Castings*, 18,000 pounds: *Hydrants*, 40 double nozzle, 5 single nozzle, 4-inch; *Stop Valves*, 6 to 16-inch; *Stop Cock Boxes*, 710; *Meter Boxes*, 20, *Brass Work*, tapping, stop and corporation cocks; *Excavating and Paving*, trenching, filling and paving; *Pig Lead*, 16,000 pounds, *Solder*, 600 pounds. Delivery to commence 15 days after signing the contract. CHARLES E. BOLLING, Superintendent of Water-Works, Richmond, Va. Feb. 22.

Trenching.—For water and drainage extension. C. BAILLAIRGE, City Engineer, Quebec, Canada, Feb. 22.

Cedar Block Paving, Stone and Lumber.—1000 toise of stone, 3,000,000 ft. B. M. of lumber, and cedar block paving for streets. WM. CARLYLE, Chairman Works Committee, Toronto, Canada. Feb. 22.

Cleaning Canals.—Cleaning the drainage canals, J. N. HARDY, Comptroller, New Orleans, La. Feb. 23.

Grammar School.—Architects, PEABODY & STEARNS, Boston. F. W. LAWRENCE, Chairman of the Selectmen, Brookline, Mass. Feb. 23.

Water Pipe.—Cast-iron pipe 6,000 ft. of 30-in., with special castings, also from 3 to 12-in. pipe, with castings, for the present year. JOHN WHITELAW, Superintendent and Engineer, Water-Works Office, Cleveland, O. February 24.

Foundations and Chimney.—The amounts in cubic yards are as follows: earth excavations, 2,400; rock, 10; American cement concrete, 600; Portland ditto; 30; brick masonry, 500; rubble stone ditto, 2,700; dimension stone ditto 50. H. T. ROCKWELL, Chairman, Water Board, Boston, Mass. February 25.

Water Pipe.—*Cast-iron*; 1,200 ft. of 6-in., 1,500 ft. of 8-in., 5 tons of special castings; deliveries, April 26 and July 1; bids per ton of 2,240 lbs. for pipe and per pound for special castings.

Wrought-iron; 500 ft. of 2-in.; 500 ft. of 1¼-in., 1,000 ft. of 1¼-in., 8,000 ft. of 1-in.,; the 1¼ and 1-in. to be for cement lining; delivered before March 20; bids per lineal foot. ENOS H. REYNOLDS Chairman, Water Board, Brockton, Mass. February 26.

Engines.—For Davis island dam. Two pairs of double reversing engines (new or second-hand), with vertical boilers; one pair to have cylinders 12x12 inches, the other 9x12 inches. Each pair with boiler to be on single bed plate on iron trucks. Lieut. Col. WM. E. MERRILL, U. S. Engineer Office, Cincinnati, O. Feb. 28.

Stone Sidewalk.—For the current year. WM. BARRETT, President, Board of Public Works, St. Paul, Minn. Feb. 28.

Dredging.—For a berth for the U. S. S. *New Hampshire*, at Coaster's Harbor island, R. I. W. S. SCHLEY, Chief of Bureau of Equipment, Navy Department, Washington, D. C. March 5.

Bridge.—Iron highway bridge on the piers and abutments of the Aqueduct bridge over the Potomac river at Georgetown, D. C.; removal of existing wooden superstructure, construction of additional masonry and embankment. LIEUT. COL. PETER C. HAINS, U. S. Engineer Office, Washington, D. C. March 7.

Pier.—Constructing 200 feet of pier, and repairing piers at Fairport harbor, O. MAJOR L. COOPER OVERMAN, U. S. Engineer Office, Cleveland, O. March 8.

Timber, Iron and Stone.—At harbor of refuge, Sand Beach, Mich. LIEUT. COL. O. M. POE, U. S. Engineer Office, Detroit, Mich. March 10.

School.—At Hartwell, O., Architect, W. W. FRANKLIN, Cincinnati. T. H. MARPE, care of the Gas Company Fourth and Plum streets, Cincinnati, O. March 11.

Harbor Improvement.—Ice pier in the Delaware river at Marcus Hook, Pa. LIEUT. COL. HENRY M. ROBERT, U. S. Engineer Office, Philadelphia, Pa. March 16.

Contracting.

Proposed Improvement, Wilmington, Del. A bill is now before the Delaware Legislature proposing to create a board of street and sewer commissioners, who have in charge the better paving of streets, and a complete system of drainage. The three commissioners are to receive an annual salary of $500 each, and severally give bonds for $30,000.

Bridge.—The following proposals have been received for the construction of a stone bridge over the Muskrat river at Pembroke, Ontario, Canada: John W. Munro, Pembroke, $19,970; W. Davis & Sons, Ottawa, Ont., $35,465; Thomas A. Moffett, Pembroke, $40,684; Patterson & Boyd, Caughnawaga, P. Q., $43,620; R. G. Reid, Lachine P. Q., $46,070.

Lumber.—The following proposals have been received by LIEUT. COL. O. M. POE, U. S. Engineer Office, Detroit, Mich., for timber and lumber for lock gates at St. Mary's Falls canal: WESTERVELT & DENNIS, Detroit, Mich: 43,720 feet B. M. of white oak, $51.50 per 1,000 feet B. M.; 8,438 feet B. M. of Norway pine, $24.50 per 1,000 feet B. M.; total, $2,589.52. SAMUEL BRADY, Detroit, Mich., $57.50; $40; $2,851.47. C. S. LLOYD, Detroit, Mich., $64.90; $34.90; $3,131.97.

Bridge.—A new steel bridge is to be built over the Chicago river at Jackson street, Chicago, Ill. It will be a double roadway, steam power bridge, with 280 feet draw span at center. There will be an iron viaduct over the railroad tracks with one 60 feet girder and one 70 feet girder and a 75 feet pony span. There will be piling and docking; five stone piers; retaining walls 590 feet on west side and 416 feet on the east side. Engine and machinery will be required. S. G. ARTINGSTALL, City Engineer, is engaged on the plans. The estimated cost is $250,000. Proposals will soon be advertised for

Chicago Drainage District.—A bill is before the Illinois Legislature to form a Chicago Drainage District to include the towns of North Chicago, South Chicago, West Chicago, Hyde Park, Lake, Calumet, Worth, Lyons, Cicero, Jefferson, Norwood Park, Lake View

New Croton Aqueduct.—The following table shows the proposals opened by the Aqueduct Commissioners, New York City, on February 11th, for the construction of Section 15, the Gate House at 135th street: (the proposals received in accordance with the first advertisement were given in ENGINEERING NEWS, January 22.)

Section 15.			Rich. A. Malone, Lancaster, Pa.		John Pierce, New York City.		John Brown, Mohawk, N. Y.		Paige & Carey, New York City.		Frank Stollmeyer, New York City.		Leavey & Buckley, Albany, N. Y.		Smith & Brown, New York City.		Engineer's Estimate.	
Items.	Quantities.	Units of Payment.	Price	Amt.	Price	Amt.	Price	Amt.	Price	Amt.	Price	Amt.	Price	Amt.	Price	Amt.	Price	Amt.
Earth excavation in open trench	2,000	cu. yds.	.50	1,000	.75	1,500.00	.42	840	.30	600	.50	1,000.00	.33	780.00	1.00	2,000	0.40	800.00
Rock excavation in open trench	9,000	"	2.50	22,500	3.50	31,500.00	3.00	27,000	3.40	30,600	2.75	24,750.00	1.99	17,910.00	3.00	27,000	2.50	22,500.00
Soiling	300	"	.70	210	.75	225.00	.75	225	.30	90	.50	150.00	.50	150.00	1.00	300	0 75	225.00
Refilling	5,000	"	.50	2 500	.50	2,500.00	.45	2,250	.30	1,500	.30	1,500 00	.48	2,400.00	.45	2,250	0.50	2,500.00
Brick masonry	1,000	"	11.00	11,000	11.00	11,000.00	12.00	12,000	10.00	10,000	12.50	12,500.00	12 50	12,500.00	12.00	12,000	11.00	11,000.00
Face brick masonry	80	"	30.00	2,400	35.00	2,800.00	27.00	2,160	40.00	3,200	30.00	2 400.00	23.00	1,840.00	36.00	2,880	50.00	4,000.00
Concrete masonry, 5 parts broken stone to 1 of cement	100	"	5.00	500	6.00	600.00	5.00	500	4.00	400	5.00	500.00	5.25	525.00	4.00	400	6.00	600.00
Concrete masonry, 3 parts broken stone to 1 of cement	50	"	6.00	300	7.00	350.00	7.00	350	5.00	250	6.00	300.00	6.00	300.00	5.40	270	7.00	350.00
Rubble stone masonry	3,000	"	6.00	18,000	4.50	13,500.00	8.00	24,000	5.00	15,000	5.50	16,500.00	5.50	16,500.00	5.40	16,200	6.00	18,000.00
Cut paving	80	"	18.00	1,440	16.69	1,335.20	13.00	1,040	20.00	1,600	16.00	1,280.00	12.00	960.00	12.00	960	10.00	800.00
Cut facing stone masonry	700	"	18.00	12,600	21.69	15,183.00	18.00	12,600	30.00	21,000	28.00	19,600.00	25.00	17,500.00	18.00	12,600	20.00	14,000.00
Granite dimension stone masonry	1,500	"	30.00	45,000	25.94	38,910.00	29.50	44,250	25.00	37,500	32.00	48,000.00	45.00	17,500.00	49.00	73,500	50.00	75,000.00
Rock face dimension stone masonry	250	"	20.00	5,000	23.09	5,922.50	15.00	3,750	23.00	5,750	25.00	6,250.00	17.00	4,250.00	18.00	4,500	30.00	7,500.00
Broken ashlar masonry	200	"	25.00	5,000	27.69	5,538.00	15.00	3,000	16.00	3,200	30.00	6,000.00	10.00	2,000.00	17.00	3,400	15.00	3,000.00
Rough pointed face dressing	20,000	sq. ft.	.25	5,000	.37	7,400.00	.50	10,000	.50	10,000	.25	5,000.00	.43	8,600.00	.25	5,000	0.25	5,000.00
Fine hammer (six cut) face dressing	14,000	"	.75	10,500	.85	11,900.00	.60	8,400	.80	11,200	.60	8,400.00	.85	11,900.00	.45	6,300	0.50	7,000.00
Extra cost of masonry when Portland cement is used	1,000	cu. yds.	1.00	1,000	1.00	1,000.00	1.50	1,500	1.50	1,500	1.00	1,000.00	1.45	1,450.00	1.50	1,500	2.00	2,000.00
Extra cost of masonry when 1 vol. American cement is used to 1 of sand	1,000	"	.75	750	1.00	1,000.00	1.50	1,500	1.50	1,500	.80	800.00	1.10	1,100.00	.50	500	1.00	1,000.00
Wrought-iron, placed	50	tons.	90.00	4,500	90.00	4,500.00	65.00	3,250	70.00	3,500	110 00	5,500.00	87.00	4,350.00	90.00	4,500	160.00	8,000.00
Cast-iron hub and spigot pipe 48" diameter and under, placed or laid	35	"	45.00	1,575	35.00	1,225.00	55.00	1,925	80.00	2,800	45.00	1,575.00	48.00	1,680.00	50.00	1,750	40.00	1,400.00
Cast-iron specials, placed or laid	73	"	60.00	4,380	80.00	5,840.00	75.00	5,475	80.00	5,840	90.00	6,570.00	81.00	5,913.00	67.00	4,891	60.00	4,380.00
Slate roof	43	squares.	12.00	516	10.00	430.00	6.00	258	30.00	1,290	.20	860.00	12.50	537.50	14.00	602	10.00	430.00
Copper gutters and flashings	900	sq. ft.	.25	225	.25	225.00	.60	540	.30	270	.374	337.50	.47	423.00	.90	810	0 35	315.00
Yellow pine matched boards	6,000	M. B. M.	60.00	360	60.00	360.00	50.00	300	60.00	360	60.00	360.00	85.00	510.00	90.00	540	100.00	600.00
Totals				156,256		164,743.70		167,113		168,450		171,132.50		181,578.50		184,653		190,400.00

Miles and Evanston. The district to be managed by three commissioners, at $5,000 per annum each, to hold office for four years. These commissioners shall devise, construct and maintain by special assessments upon property benefited a complete system of drainage. The aggregate amount of assessments shall not exceed $6,000,000 within three years after the act goes into effect.

The Railroad Construction Co. has been incorporated at Jersey City, N. J., by Edward Lauterbach, New York City, and others. Capital stock, $100,000.

New Croton Aqueduct.—The following proposals were opened by the Aqueduct Commissioners, New York City, on Feb. 16, for the construction of Shaft 13 *a*: shaft excavation, 150 lin. ft.; engineer's estimate, $80, $12,000; O'Brien & Clark, $140, $21,000; Geo. E. Clark, $80, $12,000. Brick masonry, 250 cu. yds.; $13, $3,250, $12, $3,000; $12, $3,000. Concrete masonry, (*c*), 150 cu. yds.; $6, $900; no bids; $5.50, $8.25. Concrete masonry, (*d*) 75 cu. yds.; $7, $525, $4, $300, $5, $375. Rubble stone masonry, 15 cu. yds.; $5, $75, $5, $75; $4.50, $67.50 Shaft filling, 575 cu. yds.; 75 cts., $431.25; 50 cts., $287.50, 50 cts. $287.50. Cut stone masonry, 10 cu. yds.; $30, $300; $40, $400; $40, $400. Totals engineer's estimate, $17,481.25; O'Brien & Clark, $25,062.50; Geo. E. Clark, $16,955.

The Lidgerwood Manufacturing Co., 96 Liberty St., New York, have just issued a new catalogue for 1887. It is replete with everything in the way of hoisting engine and apparatus, including boilers. Copies furnished engineers and prospective buyers.

Steel Armor.—The Secretary of the Navy has issued a circular to about 50 domestic steel manufacturers, giving full information as to the requirements of the Department for armor plates and gun forgings for the monitors and cruisers. The date for receiving proposals has been extended to March 15.

Improved Dredger.—Messrs. WM. BUTLER, Jr. and WM. H. CLARK, of Lockport, N. Y., have just obtained patents for an improvement in dredging machines. As described, the improvement consists in a boom working on either side of the dredge which picks up the derrick boxes, filled by the dipper, and empties them on the banks or in a scow anywhere within 100 ft. on either side of the dredge. It is claimed to be a very good thing by contractors who have seen it.

Railroad Contracts.—JAMES REID, of Montreal, the contractor for the Lachine bridge, has been awarded the contract for the construction of the Sault Ste. Marie branch of the Canadian Pacific R. R., about 51 miles long.

BURKITT & MURPHY, of Palestine, Tex., have been awarded the contract for the construction of the Bastrop & Houston R. R.

WILLIAM DALLIN, of Chicago, Ill., has been awarded the contracts for the construction of the Sturgis & State Line R. R., the Battle Creek & Sturgis R. R. and the Indianapolis & Southern R. R., making a continuous line from Battle Creek, Mich., to St. Louis, Mo. The contracts include grading, track laying, depots, etc. Work will be commenced at Battle Creek about March 1, and is to be completed by December.

WALTER & EVANS, of Wytheville, Va., have been awarded the contract for grading nine miles of the extension of the Norfolk & Western R. R. from Pocahontas, Va., to the Ohio river.

MILLS & FAIRFAX have been awarded the contract for grading seven miles and building a 3,000 ft. tunnel through Flat Top mountain for the above extension, of the Norfolk & Western R. R., and for grading a five miles branch of the Cripple Creek extension of the same road.

MILLER, LOOMIS & GILL, of Chicago, have established headquarters at La Plata, Mo., for their contract on the Chicago, Santa Fé & California R. R.

Dredging.—B. H. MEUHLE, U. S. Assistant Engineer, is making a survey of the harbor at Cheboygan, Mich., preparatory to letting contracts for completing the dredging 15 ft; $24,000 will be expended on the harbor.

City Work.—At Cincinnati, O., the contract for granite paving on Freeman avenue, has been awarded to FOLZ, ASHMAN & Co., at their total bid of $184,992.27. (See ENG. NEWS, p. 116). Residents of Eighth street have petitioned for asphalt paving.

At Minneapolis, Minn., 5 per cent. bonds for $1,110,000 are to be issued for public works; of this amount $225,000 is for sewers in North and Northeast Minneapolis, and in the second ward.

At San Jose, Cal., the city engineer has been directed to prepare plans and specifications for a vitrified pipe sewer.

At Utica, N. Y., a considerable amount of paving is contemplated.

At St. Paul, Minn., contracts have been awarded as follows: grading, J. N. FIELDING, $12,895; paving, J. N. FIELDING, $14,400; S. P. FOLSOM, JR., $54,910; sewers, JAMES HANSEN, $695; FRANK HANSEN, $1,520. Other street work has been authorized.

Pipe, Hydrants, Etc.—At Hamilton, Ont., the waterworks committee has awarded contracts for supplies as follows: cast-iron pipe and stop valves, A. GARTSHORE & Co., of Hamilton; 60,000 lbs. of lead pipe, WOOD & LEGGAT, of Hamilton; hydrants and castings, OSBORNE-KILLEY Manufacturing Co.; of Hamilton; pig lead, GEO. DIGBY & SONS, of Montreal; brass work, CHARLES BLACK.

At Newport, Ky., the water-works trustees have awarded contracts as follows: stop cocks, GEORGE FEWLASS; stop cock boxes, H. J. CORDEMAN & SON; lead pipe and solder, JAMES MCDONALD & SON, of Cincinnati; laying service branches, WILLIAM WHITE.

Depots.—The N. Y., L. E. & W. R. R. Co. will soon commence work on the building to contain the waiting rooms, offices, etc., at their depot in Jersey City, N. J. —The Iron Mountain R. R. and St. Louis & Texas R. R. Co. will erect a union depot at Texarkana, Ark., at a cost of $75,000.—The Chicago, Milwaukee & St. Paul R. R. Co. has purchased ground for passenger and freight depots at Kansas City, Mo.—The Louisville & Nashville R. R. Co. contemplates the erection of a union depot at Nashville, Tenn.—The Piedmont & Cumberland R. R. Co. has awarded the contract for the union depot at Cumberland, Md., to E. J. FREDLOCK, of Piedmont, W. Va.—The Cape Fear & Yadkin Valley R. R. Co. has awarded the contract for a depot at Greensboro, N. C., to THOMAS WOODROFFE.

Filling.—At Brooklyn, N. Y., the Board of Park Commissioners has received the following proposals for filling in the Concourse lowlands at Coney Island: J. Curran, white sand, 25 cts. per cub. yd.; earth gravel or loam, $1; for 5,000 yds. or more. Peter Ciancimino, white sand, 30 cts.; earth, 65 cts.; gravel, 70 cts.; loam, $1.50; for 5,000 yds. or more. Geo. R. Lyons & Co., sand, 10 cts.; earth, 50 cts.; gravel, 75 cts.; loam, 65 cts.; for 1,000 yds. Thomas McDonough, sand, 77 cts.; earth, $1.87; gravel, $4.27; top soil, $2.67; for 1,000 yards. Chas. Hart, sand, (185,000 yds.) 27 cts.; earth, (76,000 yds.), 65 cts.; gravel, (76,000 yds.), 65 cts.; loam, (62,500 yds.), 80 cts. Ditmar & Jenkins, of Gravesend: sand, 15 cts.; earth or gravel, 47 cts.; loam, 85 cts.; lump sum for work, $30,000. E. J. Curtin, sand, 10 cts. Richard Whelan, dirt, $1.25; sand, 35 cts.

Bridges.—The Phœnix Bridge Co., of Phœnixville, Pa., has been awarded the contract for a steel bridge across the Ohio river, between Covington and Cincinnati; the bridge will cost $1,000,000.

The Union Bridge Co., of Buffalo, N. Y., has been awarded the contract for the superstructure of the Mississippi river bridge at Fort Madison, Ia. The bridge is for the Kansas City and Chicago line of the Atchison, Topeka & Santa Fé R. R., and will have wagon ways on either side of the tracks. It was designed by OCTAVE CHANUTE, M. Am. Soc. C. E., of Kansas City, Mo. JOSEPH G. GILCHRIST is the engineer in charge.

Water-Works.—The contract for the water-works at Concordia, Kan., has been awarded to COOPER & COLE BROS., of Lincoln, Neb., for $45,000.

The contract for the water-works at Elgin, Ill., has been awarded to the Holly Manufacturing Co., of Lockport, N. Y., for $169,400 exclusive of the stand-pipe.

The contract for the water-works at Xenia, O., has been awarded to GOODHUE & BIRNIE, of Springfield, Mass.; the franchise is held by JOHN P. MARTIN.

The contract for the water-works at Baton Rouge, La., has been awarded to E. W. ABENDROTH, of New York City; the works to be commenced within 60 days and completed in eight months.

Sooysmith & Co.—The company has filed incorporation papers in the county clerk's office at Jersey City, N. J. Capital stock, $200,000. The incorporators are WILLIAM SOOYSMITH, CHARLES SOOYSMITH, HOFFMAN ATKINSON, E. J. ABBOTT and WILLIAM FRIEND, all of New York. The company will undertake the construction and repair of bridges, tunnels, railroads, piers and other works.

Proposals for Dredging Channel in Back Cove, Portland, Maine.

UNITED STATES ENGINEER OFFICE.
PORTLAND, MAINE, Feb. 15, 1887.

SEALED PROPOSALS in triplicate, for dredging in channel of Back Cove, Portland, Maine, will be received at this office, No. 537 Congress St., until 3 P. M. Friday, Mar. 11, 1887, and will be opened immediately thereafter in the presence of such bidders as may attend.

All necessary blank forms, and full information on the subject will be furnished to parties desiring to bid, on application at this office.

JARED A. SMITH.
Major of Engineers.

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